EZ Cut CNC User Manual

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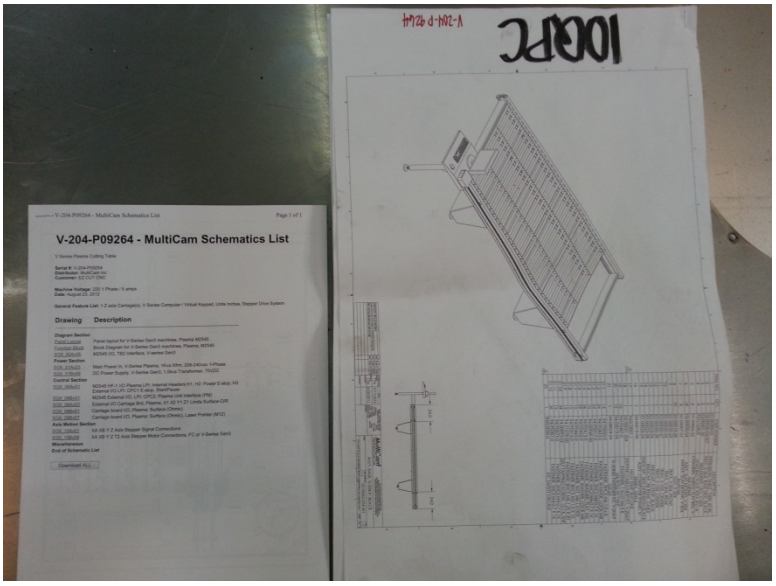
Read this manual before using this product.

Failure to follow the instructions and safety precautions in this manual can result in serious injury or death.

Keep this manual in a safe location, along with the schematics and mechanical drawings (shown in the picture below) that are included within your shipment.



Disclaimer

Before your EZ Cut CNC Technician leaves your site upon completion of the installation and training, he will secure a USB flash drive on the inside of the door to your system's control box. This flash drive will contain the following documents:

- The first QC for your system from Motion Mechanic
- At Show of your system for at least four cuts from the shape library in EZ G Code Creator
- A digital copy of the EZ Cut CNC User Manual
- A digital copy of your plasma power supply and torch

This flash drive is solely to be used by an EZ Cut CNC technician. **Do not** remove or add any files to the flash drive. And **do not** remove the flash drive unless instructed to do so by your EZ Cut CNC technician.

Contents

Customer Responsibilities for Safety

As the user of the EZ Cut, each customer **must** follow all safety procedures that are clearly outlined when operating each machine and its parts. Failure to do so may result in damage to property or personnel and could even result in death. These machines are powerful and should always be treated with care.

Customers should make plans for safeguarding themselves and their work areas at the point of operation as all EZ Cut machines have been designed and constructed to operate under specific parameters relating to the particular application. As a result, ANSI B-11 *Safety Standards* states that "It shall be the responsibility of the end-user (buyer) to provide, and ensure the use of a guard, guarding device, awareness barrier, awareness device or shield..." in order to maintain the required level of protection.

EZ Cut has available certain safety shields and guards applicable to our machines. Please contact our office for styles, types, and prices.

Personal Safety Precautions 

All customers should become familiar with all aspects of their machines.

Any person who operates or does any maintenance on this equipment should be aware that safety procedures are an important part of the daily job. Customers and related personnel should learn how the equipment functions and be able to respect the capabilities of the machinery. Anyone working on or around the equipment should understand the potential losses associated with mishandling the machinery and its parts and be able and willing to follow all safety precautions. Sudden movement, loud noises, horseplay, etc. must be avoided; as such distractions may result in unsafe conditions.

Accidents can occur if clothing or other articles become entangled in the plasma head or other moving parts of the machines. The following suggestions, if followed, will reduce the chance of having these types of accidents:

1. Wear **approved eye and hearing protection** at all times when operating the plasma system.
2. Restrain long hair with a **cap or net** when near the machines.
3. Avoid wearing neckties and scarves during machine operation.
4. Avoid wearing loose fitting clothing during machine operation.
5. Avoid wearing hanging jewelry during machine operation.
6. Wear cloth or lint-free gloves only when handling sharp or hot parts.
7. Avoid operating this and any other equipment if affected by alcohol, drugs, or any other substance or condition that may decrease judgment or alertness.
8. **Observe and follow all safety signs** on the machine and in the surrounding areas.
9. Avoid placing hands on the tabletop when the head assembly is turned on.
10. Lock out the incoming power supply when any type of maintenance or other work is being performed on the machine.

Work Area Safety

Fire extinguishers should always be readily accessible, and operators should always familiarize themselves with the fire prevention recommendations for each component of the CNC system. It is important to always keep the work area **clean and uncluttered**. Oil, debris, or water on the floor can cause unsafe conditions. Customers should be sure that all work areas are free of hazardous obstructions and that all tools and other equipment are returned to their proper storage place when not in use. Operators should never leave the machine unattended during the cutting sequence.

Installation Safety

An electrician must read and understand the electrical schematics prior to connecting the machine to the local power system. Connecting the wrong voltage power will void the warranty. All switches should be turned to the OFF position before power is connected. The main disconnect switch should always be locked in the OFF position if the machine is left unattended. When the machine is installed, the electrician or customer should be sure that all motors rotate in the correct direction.

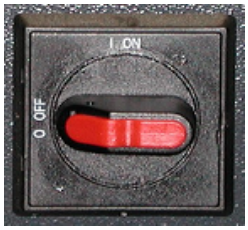
Power Lockout Instructions

EZ Cut machines are equipped with a built-in main power lockout device. If any kind of repair work or maintenance is being performed to the machine or control cabinet, the operator should **disconnect power** from the machine **before starting work**.

1. Turn the main disconnect switch to the OFF position.

2. Flip out the plastic lockout latch.

3. Insert any padlock into one of the holes of the lockout latch. With the plastic lockout latch in this position, the switch cannot be moved to the ON position.



1

2

3

4. Throw the bulkhead switch to the OFF position.

5. Open the control cabinet.

6. Make sure the LEDs on the drives and inverters are not lit. It may take a few minutes for the light from the LEDs to fade away.

7. Make sure the incoming voltage for L1, L2, and L3 is 0v.

8. Follow the operator's standard Tag Out procedure in tagging the disconnect switch.

Labels

Each machine produced includes certain cautions, warnings, dangers, and notices placed on the moving parts of the machine (e.g., gantry, carriage) as well as the stationary parts (e.g., electrical enclosure). These labels are in place to encourage employees to observe safe operating practices at all times. The text on these labels is almost always capitalized and presented in bold format. Any auxiliary equipment (e.g., fume extractor, chiller) will include vendor-specific labels advising the customer of proper safety practices regarding those units as well. The most common labels are identified below.

Cautions

Caution labels indicate the potential for minor or moderate injury and are usually yellow with black writing. These labels are normally placed on the gantry, axis covers, and any other covers that are located at the front of the machine.

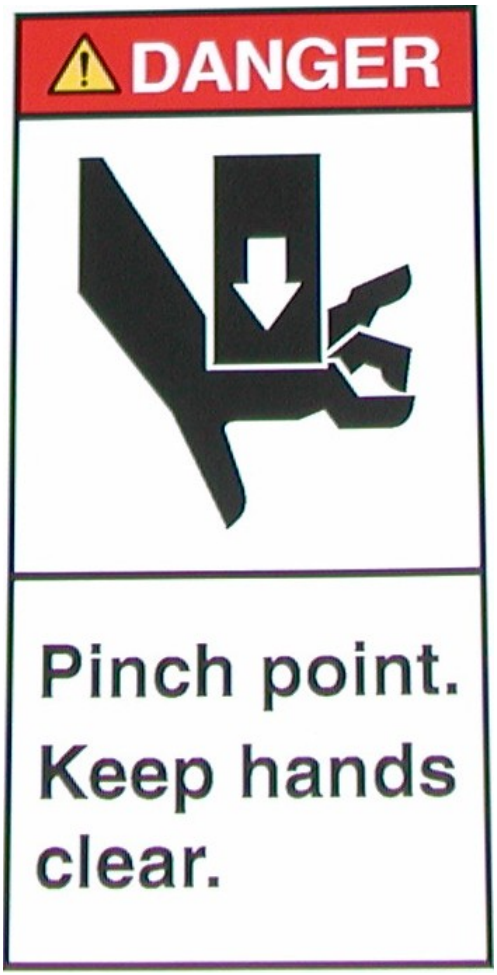
Warnings

Warning labels indicate the potential for death or serious injury and usually show the word WARNING in black writing against an orange background. These labels are normally located in areas where serious injury could be sustained, such as the carriage.


WARNING
Enclosure is TOP–HEAVY
• Stabilize enclosure before opening doors.
• Follow guidelines in "Large Enclosure Handling Manual".
• DO NOT remove this label until enclosure is permanently installed.
• Label must be reattached if removed for painting.
• To get additional copies of the "Large Enclosure Handling Manual" or labels, call 1–800–355–3560.
93268001, Dwg. Rev. G

Danger

Danger labels indicate the probability of death or serious injury and usually show the word DANGER in white writing against a red background. These labels are normally located in areas where serious injury could occur, such as the knife cartridge.



Notices

Notice labels indicate the potential for property damage and usually show the word NOTICE in white writing against a blue backdrop. This label is normally located at the front of the machine.

Safety and Compliance Manual

806690 – Revision 0

English

Important

Read and understand all safety information before using any Hypertherm products.

A PLASMA ARC CAN DAMAGE FROZEN PIPES

Frozen pipes may be damaged or can burst if you attempt to thaw them with a plasma torch.

STATIC ELECTRICITY CAN DAMAGE CIRCUIT BOARDS

Use proper precautions when handling printed circuit boards:

Grounding Safety

Work cable Attach the work cable securely to the work piece or the work table with good metal-to-metal contact. Do not connect it to the piece that will fall away when the cut is complete.

Work table Connect the work table to an earth ground, in accordance with appropriate national and local electrical codes.

Input power

- Be sure to connect the power cord ground wire to the ground in the disconnect box.
- If installation of the plasma system involves connecting the power cord to the power supply, be sure to connect the power cord ground wire properly.
- Place the power cord's ground wire on the stud first, then place any other ground wires on top of the power cord ground. Fasten the retaining nut tightly.
- Tighten all electrical connections to avoid excessive heating.

Electrical Hazards

- Only trained and authorized personnel may open this equipment.
- If the equipment is permanently connected, turn it off, and lock out/ tag out power before the enclosure is opened.
- If power is supplied to the equipment with a cord, unplug the unit before the enclosure is opened.
- Lockable disconnects or lockable plug covers must be provided by others.
- Wait 5 minutes after removal of power before entering the enclosure to allow stored energy to discharge.
- If the equipment must have power when the enclosure is open for servicing, arc flash explosion hazards may exist. Follow ALL local requirements (NFPA 70E in the USA) for safe work practices and for Personal Protective Equipment when servicing energized equipment.
- The enclosure shall be closed and the proper earth ground continuity to the enclosure verified prior to operating the equipment after moving, opening, or servicing.
- Always follow these instructions for disconnecting power before inspecting or changing torch consumable parts.

Electric Shock can Kill

- Touching live electrical parts can cause a fatal shock or severe burn.
- Operating the plasma system completes an electrical circuit between the torch and the work piece. The work piece and anything touching the work piece are part of the electrical circuit.
- Never touch the torch body, work piece or the water in a water table when the plasma system is operating.

Electric shock prevention

All Hypertherm plasma systems use high voltage in the cutting process (200 to 400 VDC are common). Take the following precautions when operating this system:

- Wear insulated gloves and boots, and keep your body and clothing dry.
- Do not stand, sit or, lie on – or touch – any wet surface when using the plasma system.
- Insulate yourself from work and ground using dry insulating mats or covers big enough to prevent any physical contact with the work or ground. If you must work in or near a damp area, use extreme caution.
- Provide a disconnect switch close to the power supply with properly sized fuses. This switch allows the operator to turn off the power supply quickly in an emergency situation.
- When using a water table, be sure that it is correctly connected to earth ground.
- Install and ground this equipment according to the instruction manual and in accordance with national and local codes.
- Inspect the input power cord frequently for damage or cracking of the cover. Replace a damaged power cord immediately. **Bare wiring can kill.**
- Inspect and replace any worn or damaged torch leads.
- Do not pick up the work piece, including the waste cutoff, while you cut. Leave the work piece in place or on the workbench with the work cable attached during the cutting process.
- Before checking, cleaning or changing torch parts, disconnect the main power or unplug the power supply.
- Never bypass or shortcut the safety interlocks.
- Before removing any power supply or system enclosure cover, disconnect electrical input power. Wait 5 minutes after disconnecting the main power to allow capacitors to discharge.
- Never operate the plasma system unless the power supply covers are in place. Exposed power supply connections present a severe electrical hazard.
- When making input connections, attach proper grounding conductor first.
- Each Hypertherm plasma system is designed to be used only with specific Hypertherm torches. Do not substitute other torches which could overheat and present a safety hazard.

Fire prevention

- Be sure the area is safe before doing any cutting. Keep a fire extinguisher nearby.
- Remove all flammables within 35 feet (10 m) of the cutting area.
- Quench hot metal or allow it to cool before handling or before letting it touch combustible materials.
- Never cut containers with potentially flammable materials inside – they must be emptied and properly cleaned first.
- Ventilate potentially flammable atmospheres before cutting.
- When cutting with oxygen as the plasma gas, an exhaust ventilation system is required.

Explosion Prevention

- Do not use the plasma system if explosive dust or vapors may be present.
- Do not use pressurized cylinders, pipes, or any other closed container.
- Do not cut containers that have held combustible materials.

WARNING

Explosion Hazard

Argon-Hydrogen and Methane

Hydrogen and methane are flammable gases that present an explosion hazard. Keep flames away from cylinders and hoses that contain methane or hydrogen mixtures. Keep flames and sparks away from the torch when using methane or argon-hydrogen plasma.

WARNING

Explosion Hazard
Underwater Cutting with Fuel Gases

- Do not cut under water with fuel gases containing hydrogen.
- Cutting under water with fuel gases containing hydrogen can result in an explosive condition that can detonate during plasma cutting operations.

WARNING

Hydrogen Detonation with Aluminum Cutting

- Do not cut aluminum underwater or with water touching the underside of the aluminum.
- Cutting aluminum underwater or with the water touching the underside of the aluminum can result in an explosive condition that can detonate during plasma cutting operations.

Compressed Gas Equipment Safety

- Never lubricate cylinder valves or regulators with oil or grease.
- Use only correct gas cylinders, regulators, hoses and fittings designed for the specific application.
- Maintain all compressed gas equipment and associated parts in good condition.
- Label and color-code all gas hoses to identify the type of gas in each hose. Consult applicable national and local codes.

Gas Cylinders can explode if Damaged

- Gas cylinders contain gas under high pressure. If damaged, a cylinder can explode.
- Handle and use compressed gas cylinders in accordance with applicable national and local codes.
- Never use a cylinder that is not upright and secured in place.
- Keep the protective cap in place over valve except when the cylinder is in use or connected for use.
- Never allow electrical contact between the plasma arc and a cylinder.
- Never expose cylinders to excessive heat, sparks, slag or open flame.
- Never use a hammer, wrench or other tool to open a stuck cylinder valve.

Toxic Fumes can cause Injury or Death

- The plasma arc by itself is the heat source used for cutting. Accordingly, although the plasma arc has not been identified as a source of toxic fumes, the material being cut can be a source of toxic fumes or gases that deplete oxygen.
- Fumes produced vary depending on the metal that is cut. Metals that may release toxic fumes include, but are not limited to, stainless steel, carbon steel, zinc (galvanized), and copper.
- In some cases, the metal may be coated with a substance that could release toxic fumes. Toxic coatings include, but are not limited to, lead (in some paints), cadmium (in some paints and fillers), and beryllium.
- Gases produced by plasma cutting vary based on the material to be cut and the method of cutting, but may include ozone, oxides of nitrogen, hexavalent chromium, hydrogen, and other substances if such are contained in or released by the material being cut.
- Caution should be taken to minimize exposure to fumes produced by any industrial process. Depending upon the chemical composition and concentration of the fumes (as well as other factors, such as ventilation), there may be a risk of physical illness, such as birth defects or cancer.
- It is the responsibility of the equipment and site owner to test the air quality in the area where the equipment is used and to ensure that the air quality in the workplace meets all local and national standards and regulations.
- The air quality level in any relevant workplace depends on site-specific variables such as:
    - Table design (wet, dry, underwater).
    - Material composition, surface finish, and composition of coatings.
    - Volume of material removed.
    - Duration of cutting or gouging.
    - Size, air volume, ventilation and filtration of the work area.
    - Personal protective equipment.
    - Number of welding and cutting systems in operation.
    - Other site processes that may produce fumes.
- If the workplace must conform to national or local regulations, only monitoring or testing done at the site can determine whether the site is above or below allowable levels.
- To reduce the risk of exposure to fumes:
    - Remove all coatings and solvents from the metal before cutting.
    - Use local exhaust ventilation to remove fumes from the air.
    - Do not inhale fumes. Wear an air-supplied respirator when cutting any metal coated with, containing, or suspected to contain toxic elements.
    - Assure that those using welding or cutting equipment, as well as air- supplied respiration devices, are qualified and trained in the proper use of such equipment.
    - Never cut containers with potentially toxic materials inside. Empty and properly clean the container first.
    - Monitor or test the air quality at the site as needed.
    - Consult with a local expert to implement a site plan to ensure safe air quality.

ARC RAYS CAN BURN EYES AND SKIN

Eye protection Plasma arc rays produce intense visible and invisible (ultraviolet and infrared) rays that can burn eyes and skin.

- Use eye protection in accordance with applicable national and local codes.
- Wear eye protection (safety glasses or goggles with side shields, and a welding helmet) with appropriate lens shading to protect your eyes from the arc's ultraviolet and infrared rays.

Skin protection Wear protective clothing to protect against burns caused by ultraviolet light, sparks, and hot metal.

- Gauntlet gloves, safety shoes and hat.
- Flame-retardant clothing to cover all exposed areas.
- Cuff-less trousers to prevent entry of sparks and slag.
    - Remove any combustibles, such as butane lighter or matches, from your pockets before cutting.

Cutting area Prepare the cutting area to reduce reflection and transmission of ultraviolet light:

- Paint walls and other surfaces with dark colors to reduce reflection.
- Use protective screens or barriers to protect others from flash and glare.
- Warn others not to watch the arc. Use placards or signs.

Arc current (amps)	Minimum protective shade number (ANSI Z49.1:2005)	Suggested shade number for comfort (ANSI Z49.1:2005)	OSHA 29CFR 1910.133(a)(5)	Europe EN 169:2002
Less than 40 A	5	5	8	9
41 to 60 A	6	6	8	9
61 to 80 A	8	8	8	9
81 to 125 A	8	9	8	9
126 to 150 A	8	9	8	10
151 to 175 A	8	9	8	11
176 to 250 A	8	9	8	12
251 to 300 A	8	9	8	13
301 to 400 A	9	12	9	13
401 to 800 A	10	14	10	N/A

Pacemaker and Hearing Aid Operation

- Pacemaker and hearing aid operation can be affected by magnetic fields from high currents.
- Pacemaker and hearing aid wearers should consult a doctor before going near any plasma arc cutting and gouging operations.
- To reduce magnetic field hazards:
    - Keep both the work cable and the torch lead to one side, away from your body.
    - Route the torch leads as close as possible to the work cable.
    - Do not wrap or drape the torch lead or work cable around your body.
    - Keep as far away from the power supply as possible.

NOISE CAN DAMAGE HEARING

- Cutting with a plasma arc can exceed acceptable noise levels as defined by local codes in many applications. Prolonged exposure to excessive noise can damage hearing. Always wear proper ear protection when cutting or gouging, unless sound pressure level measurements taken at the installed site have verified personal hearing protection is not necessary per relevant international, regional, and local codes.
- Significant noise reduction can be obtained by adding simple engineering controls to cutting tables such as barriers or curtains positioned between the plasma arc and the workstation; and/or locating the workstation away from the plasma arc. Implement administrative controls in the workplace to restrict access, limit operator exposure time, screen off noisy working areas and/or take measures to reduce reverberation in working areas by putting up noise absorbers.
- Use ear protectors if the noise is disruptive or if there is a risk of hearing damage after all other engineering and administrative controls have been implemented. If hearing protection is required, wear only approved personal protective devices such as ear muffs or ear plugs with a noise reduction rating appropriate for the situation. Warn others in the area of possible noise hazards. In addition, ear protection can prevent hot splatter from entering the ear.

DRY DUST COLLECTION INFORMATION

- At some sites, dry dust can represent a potential explosion hazard.
- The U.S. National Fire Protection Association's 2007 edition of NFPA standard 68, "Explosion Protection by Deflagration Venting," provides requirements for the design, location, installation, maintenance, and use of devices and systems to vent combustion gases and pressures after any deflagration event. Consult with the manufacturer or installer of any dry dust collection system for applicable requirements before you install a new dry dust collection system or make significant changes in the process or materials used with an existing dry dust collection system.
- Consult your local "Authority Having Jurisdiction" (AHJ) to determine whether any edition of NFPA 68 has been "adopted by reference" in your local building codes.
- Refer to NFPA68 for definitions and explanations of regulatory terms such as deflagration, AHJ, adopted by reference, the Kst value, deflagration index, and other terms.
- Note 1 – Hypertherm's interpretation of these new requirements is
- that unless a site-specific evaluation has been completed to determine that all dust generated is not combustible, the 2007 edition of NFPA
- 68 requires the use of explosion vents designed to the worst-case
- Kst value (see annex F) that could be generated from dust so that
- the explosion vent size and type can be designed. NFPA 68 does not specifically identify plasma cutting or other thermal cutting processes as requiring deflagration venting systems, but it does apply these new requirements to all dry dust collection systems.
- Note 2 – Users of Hypertherm manuals should consult and comply with all applicable federal, state, and local laws and regulations. Hypertherm does not, by the publication of any Hypertherm manual, intend to urge action that is not in compliance with all applicable regulations and standards, and this manual may never be construed as doing so.

Introduction

Hypertherm maintains a global Regulatory Management System to ensure that products comply with regulatory and environmental requirements.

National and local safety regulations

National and Local safety regulations shall take precedence over any instructions provided with the product. The product shall be imported, installed, operated and disposed of in accordance with national and local regulations applicable to the installed site.

Certification test marks

Certified products are identified by one or more certification test marks from accredited testing laboratories. The certification test marks are located on or near the data plate.

Each certification test mark means that the product and its safety- critical components conform to the relevant national safety standards as reviewed and determined by that testing laboratory. Hypertherm places a certification test mark on its products only after that product is manufactured with safety-critical components that have been authorized by the accredited testing laboratory.

Once the product has left the Hypertherm factory, the certification test marks are invalidated if any of the following occurs:

- The product is modified in a manner that creates a hazard or non- conformance with the applicable standards.
- Safety-critical components are replaced with unauthorized spare parts.
- Any unauthorized assembly, or accessory that uses or generates a hazardous voltage is added.
- There is any tampering with a safety circuit or other feature that is designed into the product as part of the certification, or otherwise.

CE marking constitutes a manufacturer's declaration of conformity to applicable European directives and standards. Only those versions of Hypertherm products with a CE Marking located on or near the data plate have been tested for compliance with the European Low Voltage Directive and the European EMC Directive. EMC filters needed to comply with the European EMC Directive are incorporated within versions of the power supply with a CE Marking.

Certificates of compliance for Hypertherm products are available from the Downloads Library on the Hypertherm web site at https://www.hypertherm.com.

Differences in national standards

Nations may apply different performance, safety or other standards. National differences in standards include, but are not limited to:

- Voltages
- Plug and cord ratings
- Language requirements
- Electromagnetic compatibility requirements

These differences in national or other standards may make it impossible or impractical for all certification test marks to be placed on the same version of a product. For example, the CSA versions of Hypertherm's products do not comply with European EMC requirements, and therefore do not have a CE marking on the data plate.

Countries that require CE marking or have compulsory EMC regulations must use CE versions of Hypertherm products with the CE marking on the data plate. These include, but are not limited to:

- Australia
- New Zealand
- Countries in the European Union
- Russia

It is important that the product and its certification test mark be suitable for the end-use installation site. When Hypertherm products are shipped to one country for export to another country; the product must be configured and certified properly for the end-use site.

Safe installation and use of shape cutting equipment

IEC 60974-9, titled Arc Welding Equipment – Installation and use, provides guidance in the safe installation and use of shape cutting equipment and the safe performance of cutting operations. The requirements of national and local regulations shall be taken into consideration during installation, including, but not limited
to, grounding or protective earth connections, fuses, supply disconnecting device, and type of supply circuit. Read these instructions before installing the equipment. The first and most important step is the safety assessment of the installation.

The safety assessment must be performed by an expert, and determines what steps are necessary to create a safe environment, and what precautions should be adopted during the actual installation and operation.

Procedures for periodic inspection and testing

Where required by local national regulations, IEC 60974-4 specifies test procedures for periodic inspection and after repair or maintenance, to ensure electrical safety for plasma cutting power sources built in conformity with IEC 60974-1. Hypertherm performs the continuity of the protective circuit and insulation resistance tests
in the factory as non-operating tests. The tests are performed with the power and ground connections removed.

Hypertherm also removes some protective devices that would cause false test results. Where required by local national regulations, a label shall be attached to the equipment to indicate that it has passed the tests prescribed by IEC60974-4. The repair report shall indicate the results of all tests unless an indication is made that a particular test has not been performed.

Qualification of test personnel

Electrical safety tests for shape cutting equipment can be hazardous and shall be carried out by an expert in the field of electrical repair, preferably someone also familiar with welding, cutting, and allied processes. The safety risks to personnel and equipment, when unqualified personnel are performing these tests, may be much greater than the benefit of periodic inspection and testing.

Hypertherm recommends that only visual inspection be performed unless the electrical safety tests are specifically required by local national regulations in the country where the equipment is installed.

Residual current devices (RCDs)

In Australia and some other countries, local codes may require the use of a Residual Current Devices (RCD) when portable electrical equipment is used in the workplace or at construction sites to protect operators from electrical faults in the equipment. RCDs are designed to safely disconnect the mains electrical supply when an imbalance is detected between the supply and return current (there is a leakage current to earth). RCDs are available with both fixed and adjustable trip currents between 6 to 40 milliamperes and a range of trip times up to 300 milliseconds selected for the equipment installation, application and intended use. Where RCDs are used, the trip current and trip time on RCDs should be selected or adjusted high enough to avoid nuisance tripping during normal operation of the plasma cutting equipment and low enough in the extremely unlikely event of an electrical fault in the equipment to disconnect the supply before the leakage current under a fault condition can pose a life threatening electrical hazard to operators.

To verify that the RCDs continue to function properly over time, both the trip current and the trip time should be tested periodically. Portable electrical equipment and RCDs used in commercial and industrial areas in Australia and New Zealand are tested to the Australian standard AS/NZS 3760. When you test the insulation of plasma cutting equipment to AS/NZS 3760, measure the insulation resistance according to Appendix B of the standard, at 250 VDC with the power switch in the ON position to verify proper testing and to avoid the false failure of the leakage current test. False failures are possible because the metal oxide varistors (MOVs) and electromagnetic compatibility (EMC) filters, used to reduce emissions and protect the equipment from power surges, may conduct up to 10 milliamperes leakage current to earth under normal conditions.

If you have any questions regarding the application or interpretation of any IEC standards described here, you are required to consult with an appropriate legal or other advisor familiar with the International Electrotechnical standards, and shall not rely on Hypertherm in any respect regarding the interpretation or application of such standards.

Higher-level systems

When a system integrator adds additional equipment; such as cutting tables, motor drives, motion controllers or robots; to a Hypertherm plasma cutting system, the combined system may be considered a higher-level system. A higher-level system with hazardous moving parts may constitute industrial machinery or robotic equipment, in which case the OEM or end-use customer may be subject to additional regulations and standards than those relevant to the plasma cutting system as manufactured by Hypertherm.

It is the responsibility of the end-use customer and the OEM to perform a risk assessment for the higher-level system, and to provide protection against hazardous moving parts. Unless the higher- level system is certified when the OEM incorporates Hypertherm products into it, the installation also may be subject to approval by local authorities. Seek advice from legal counsel and local regulatory experts if you are uncertain about compliance.

External interconnecting cables between component parts of the higher level system must be suitable for contaminants and movement as required by the final end use installation site. When the external interconnecting cables are subject to oil, dust, water, or other contaminants, hard usage ratings may be required.

When external interconnecting cables are subject to continuous movement, constant flexing ratings may be required. It is the responsibility of the end-use customer or the OEM to ensure the cables are suitable for the application. Since there are differences in the ratings and costs that can be required by local regulations for higher level systems, it is necessary to verify that any external
Interconnecting cables are suitable for the end-use installation site.

Introduction

The Hypertherm Environmental Specification requires RoHS, WEEE and REACH substance information to be provided by Hypertherm's suppliers.

Product environmental compliance does not address the indoor air quality or environmental release of fumes by the end user. Any materials that are cut by the end user are not provided by Hypertherm with the product. The end user is responsible for the materials being cut as well as for safety and air quality in the workplace. The end user must be aware of the potential health risks of the fumes released from the materials being cut and comply with all local regulations.

National and local environmental regulations

National and local environmental regulations shall take precedence over any instructions contained in this manual.

The product shall be imported, installed, operated and disposed of in accordance with all national and local environmental regulations applicable to the installed site.

The European Environmental regulations are discussed later in *The WEEE Directive*.

The RoHS directive

Hypertherm is committed to complying with all applicable laws and regulations, including the European Union Restriction of Hazardous Substances (RoHS) Directive that restricts the use of hazardous materials in electronics products. Hypertherm exceeds RoHS Directive compliance obligations on a global basis.

Hypertherm continues to work toward the reduction of RoHS materials in our products, which are subject to the RoHS Directive, except where it is widely recognized that there is no feasible alternative.

Declarations of RoHS Conformity have been prepared for the current CE versions of Powermax plasma cutting systems manufactured by Hypertherm. There is also a "RoHS mark" on the Powermax CE versions below the "CE Marking" on the data plate of CE versions of Powermax series units shipped since 2006. Parts used in CSA versions of Powermax and other products manufactured by Hypertherm that are either out of scope or exempt from RoHS are continuously being converted to RoHS compliance in anticipation of future requirements.

Proper disposal of Hypertherm products

Hypertherm plasma cutting systems, like all electronic products, may contain materials or components, such as printed circuit boards, that cannot be discarded with ordinary waste. It is your responsibility to dispose of any Hypertherm product or component part in an environmentally acceptable manner according to national and local codes.

- In the United States, check all federal, state, and local laws.
- In the European Union, check the EU directives, national, and local laws. For more information, visit www.hypertherm.com/weee.
- In other countries, check national and local laws.
- Consult with legal or other compliance experts when appropriate.

The WEEE directive

On January 27, 2003, the European Parliament and the Council of the European Union authorized Directive 2002/96/EC or WEEE (Waste Electrical and Electronic Equipment).

As required by the legislation, any Hypertherm product covered by the directive and sold in the EU after August 13, 2005 is marked with the WEEE symbol. This directive encourages and sets specific criteria for the collection, handling, and recycling of EEE waste. Consumer and business-to-business wastes are treated differently (all Hypertherm products are considered business-to-business). Disposal instructions for the CE versions of Powermax plasma systems can be found at www.hypertherm.com/weee.

The URL is printed on the symbol-only warning label for each of these CE versions Powermax series units shipped since 2006. The CSA versions of Powermax and other products manufactured by Hypertherm are either out of scope or exempt from WEEE.

The REACH regulation

The REACH regulation (1907/2006), in force since June 1, 2007, has an impact on chemicals available to the European market. The REACH regulation requirements for component manufacturers states that the component shall not contain more than 0.1% by weight of the Substances of Very High Concern (SVHC).

Component manufacturers and other downstream users, such as Hypertherm, are obligated to obtain assurances from its suppliers that all chemicals used in or on Hypertherm products will have a European Chemical Agency (ECHA) registration number. To provide chemical information as required by the REACH regulation, Hypertherm requires suppliers to provide REACH declarations and identify any known use of REACH SVHC. Any use of SVHC in amounts exceeding 0.1% w/w of the parts has been eliminated. The MSDS contains a full disclosure of all substances in the chemical and can be used to verify REACH SVHC compliance.

The lubricants, sealants, coolants, adhesives, solvents, coatings and other preparations or mixtures used by Hypertherm in, on, for, or with its shape cutting equipment are used in very small quantities (except the coolant) and are commercially available with multiple sources that can and will be replaced in the event of a supplier problem associated with REACH Registration or REACH Authorization (SVHCs).

Proper handling and safe use of chemicals

Chemical Regulations in the USA, Europe, and other locations require that Material Safety Data Sheets (MSDS) be made available for all chemicals. The list of chemicals is provided by Hypertherm:

The MSDS are for chemicals provided with the product and other chemicals used in or on the product. MSDS can be downloaded from the Downloads Library on the Hypertherm web site at https://www.hypertherm.com. On the Search screen, insert MSDS in the document title and click on Search.

In the USA, OSHA does not require Material Safety Data Sheets for articles such as electrodes, swirl rings, retaining caps, nozzles, shields, deflectors and other solid parts of the torch.

Hypertherm does not manufacture or provide the materials that are cut and has no knowledge whether the fumes released from materials that are cut will pose a physical hazard or health risk. Please consult with your supplier or other technical advisor if you need guidance concerning the properties of the material you will cut using a Hypertherm product.

Fumes emission and air quality

Note: The following information on air quality is intended for general information only and should not be used as a substitute for reviewing and implementing applicable government regulations or legal standards in the country where the cutting equipment will be installed and operated.

In the USA, the National Institute for Occupational Safety and Health (NIOSH) Manual of Analytical Methods (NMAM) is a collection of methods for sampling and analyzing contaminants in workplace air. Methods published by others, such as OSHA, MSHA, EPA, ASTM, ISO or commercial suppliers of sampling and analytical equipment, may have advantages over NIOSH methods.

For example, ASTM Practice D 4185 is a standard practice for the collection, dissolution, and determination of trace metals in workplace atmospheres. The sensitivity, detection limit, and optimum working concentrations for 23 metals are listed in ASTM D 4185. An industrial hygienist should be used to determine the optimum sampling protocol, considering analytical accuracy, cost, and optimum sample number. Hypertherm uses a third party industrial hygienist to perform and interpret air quality testing results taken by air sampling equipment positioned at operator stations in Hypertherm buildings where plasma cutting tables are installed and operated.

Where applicable, Hypertherm also uses a third party industrial hygienist to obtain air and water permits.

If you are not fully aware and up to date on all applicable government regulations and legal standards for the installation site, you should consult a local expert prior to purchasing, installing, and operating the equipment.

Maintenance & Warranty

Hints and Tips

The EZ Cut has a very powerful yet easy-to-use interface. Operators who understand their systems and learn the functions can utilize their cutting systems in an efficient and productive manner. The following tips complement this knowledge and can be used to the operators' advantage.

#1 Observing Safety

Safety glasses and hearing protection should be **worn at all times** while operating the machine and long hair should be **restrained with a cap or net** when near the machines. Operators should never leave the machine unattended during the cutting sequence, and labels should be observed at all times.

#2 Maintaining the Machine

The EZ Cut will produce consistent, accurate work as long as it is well-maintained. Maintenance for this system is easy, yet it should not be overlooked. Operators may refer to the maintenance chart for more detail. All machines should be kept clean when not in use. The build-up of dust or slag on the system should be cleared daily with special attention focused on the gear rack and bearing rails, and the filter on the electronics enclosure should be cleaned.

All of the bearings should be greased at least twice a month based on an 8-hour work day. The bearings should be greased more often if the machine is in use more than 8 hours a day. The Lead Screw Z-axis should be lubricated with a non-aerosol, silicon-based lubricant. Operators are cautioned **against** using the lithium grease when lubricating Lead Screws as this may lead to premature wear of the Lead Screw. Ball Screws however can be lubricated with lithium grease.

Contacting EZ Cut

For Sales questions or concerns, please direct all necessary email correspondence to the following address:

support@ezcutcnc.com

Customers with technical questions about their EZ Cut equipment should refer to their User Manual first. Any caller with questions regarding an issue that is clearly defined in the manual will be directed back to the manual by the Service Technician.

If the customer is unable to find the answers in the User Manual, he or she may contact the local distributor. If the customer still has questions, he or she may contact EZ Cut by phone or email.

When placing a service call, customers should include the model number of the EZ Cut plasma system, serial number of the unit, and full name of the company.

EZ Cut CNC
St Louis, Missouri
Phone: (888) 759-7184
EZ Cut CNC

EZ Cut CNC Limited Warranty

This limited warranty relates to parts and labor.

Scope of Limited Warranty

EZ Cut CNC (hereinafter, "Seller") warrants to the purchaser of its products (hereinafter "Purchaser") that the products purchased are free of defects in workmanship or material for the time specified below. If Purchaser notifies Seller in writing within the time specified that the product has a defect in workmanship or material even though it has been stored, installed, operated, and maintained in accordance with Seller's specifications, instructions, recommendations and in accordance with recognized standard industry practice, and the product was not misused, repaired, neglected, altered, or damaged, the Seller will repair or replace, in its sole discretion, those parts of the product determined by Seller to be defective in workmanship or material if said defect is not attributable to Purchaser's acts or omissions.

This warranty excludes any warranty of merchantability, fitness for a particular purpose, or other warranty of quality, whether expressed, implied or statutory.

Limited Warranty Period

The cost of repair or replacement parts is covered by this limited warranty on cutting systems for ***one year*** from shipment date from Seller's factory. Labor expenses are covered by this limited warranty for ***six months*** from shipment date from Seller's factory. Normal wear items such as, switches, regulators, solenoids, drive bands, torch lifter motors, motor pinions, gear rack, and similar items are covered by this limited warranty for six months from shipment date from Seller's factory. Hoses, bulbs, and switches are covered by this limited warranty for 30 days. Components in the product that were not manufactured by Seller are excluded from this warranty, and are covered by the original manufacturer's warranty, if any.

Limitation of Liability

Seller shall not, under any circumstances, be liable for special, indirect, incidental or consequential damages (regardless of the form of action, whether in contract or in tort including negligence). In no event will this warranty obligate Seller for any amount exceeding the price of the goods upon which liability is based. Correction of non-conformities, in the manner and time provided herein, constitutes fulfillment of Seller's obligations to Purchaser with respect to Purchaser's purchase of Seller's product.

The Seller shall have no liability for damages of any kind arising from the installation, integration and/or use of the apparatus by anyone. The Buyer by the acceptance of the equipment will assume all liability for any damages which may result from its use or misuse by the buyer, his employees, or by others. Under no circumstance will the Seller be liable for any incidental or consequential damages or other loss, damage or expense of any kind including loss of profits arising in connection with the use or inability to use the products offered by the Seller.

This warranty is invalid if Purchaser used replacement parts, accessories or software that, in Seller's sole opinion impaired the safety or performance of the product. This warranty supersedes all previous warranties.

EZ Cut CNC Warranty Claim Method

Purchaser will immediately notify Seller in writing upon discovering a warranty claim. Operation of the product must be suspended until further notice from the Seller. Upon written notice from Purchaser of a warranty claim, Seller will contact Purchaser to determine the nature and extent of the repair or replacement necessary. Upon receipt of a warranty claim notice, Seller will proceed without unreasonable delay to remedy any defect found under the terms of this warranty. Seller may, at its sole option, repair or replace any defective portion of a product or product. The warranty shall not extend beyond the time set forth above for any reason. The warranty on repairs and replacements shall expire on the same date as the warranty on the originally purchased product that was repaired or replaced.

All parts returned for repair and/or replacement require a return goods authorization (RGA) number. Items sent with no documentation will be returned at the purchaser's expense.

Maintenance

The EZ Cut will provide years of productive service if it is maintained properly. There are daily, weekly, monthly, quarterly, and yearly maintenance steps required for each machine based on a 40-hour work week. Any plasma system used in excess of 40 hours a week should have the maintenance schedule adjusted accordingly. Each auxiliary system has specific maintenance procedures that must be addressed in addition to the following maintenance procedures for the CNC machine.

Daily

The EZ Cut should be cleaned off each day, and the water lines should be inspected. All dust or slag should be blown or vacuumed off the machine. Close attention should be paid to the rack area since dust or slag build-up in the rack can cause stalling problems. Operators working with systems that have a Lead Screw Z-axis should lubricate the screw with a non-aerosol, silicon-based lubricant. Operators should **not** use WD-40 on the Z-axis screw for lubrication. Using anything other than what is recommended will result in the premature wear of the Z-axis screw. With Ball Screw systems, oil or lithium grease is an acceptable lubricant. Make sure to wipe down the V-grooves with a light lubricant, such as machinist oil, in order to prevent galling.

Weekly

The EZ Cut should be cleaned thoroughly each week. The filter on the control box should be vacuumed. Any build-up in the racks or rails should be blown out. The filter or filters on the auxiliary equipment systems should be removed and cleaned. All fluid levels (if applicable) in the auxiliary equipment systems should be checked and filled if needed.

Bi-Monthly

Operators should grease all the linear bearing cars at least twice a month for the EZ Cut. Jogging the machine while applying slight pressure in the opposite direction will help force the grease into the bearing cars and incorporate the grease throughout all of the bearings.

Monthly

The racks and Y- and Z-axes screws should be cleaned with a scrub brush and degreaser once a month following the same lubrication procedure described earlier in addition to the daily and weekly cleaning for the EZ Cut. Once the racks are clean, operators should apply a bead of the lithium-based grease.

Quarterly

The X- and Y-axes covers should be removed from the EZ Cut every three months so that operators can inspect the transmission or gearboxes for wear. Operators can engage the pinion all the way into the rack by loosening the mounting bolts of the transmission or gearbox and pushing the assembly up. The tabletop bolts should be checked to ensure they are all tight.

Bi-Annually

The electrical cabinet should be checked during the bi-annual maintenance performed on the EZ Cut. Operators should lockout incoming power before opening the cabinet and then vacuum out any debris that may have entered the cabinet during regular working conditions. Operators should **not** use compressed air when cleaning out the cabinet as this action may cause unwanted particles to short out some of the electrical components.

The belts on all transmissions and Lead Screw Z-nuts must be replaced every other year.

Machine Hardware

Torch Installation

When installing the machine torch, make sure there is enough slack in the cable for the torch to move without straining the torch.

Also, at its lowest point the torch should come no more than ½" below the top of the table slats. This will help prolong the life of your consumables by allowing adequate space from the cutting surface of the material.

Securing the Computer Monitor

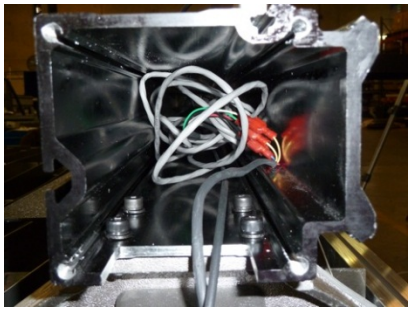
Once you have the computer and computer monitor connected and in place, you will need to secure them to the computer stand on the Xa side of the table.

Drill a hole through the top of the computer stand, as well as the base of the computer monitor. Run a ¼" bolt through the top of the drilled hole, and then secure it below the computer stand with a flat washer and a nut. This will secure the computer and monitor, protecting them from accidentally being knocked off of the stand.

Tightening Gantry Bolts

After you have found Machine Home, turn the controller off and then remove the side covers of the gantry. You will see four bolts on the bottom of the gantry. Tighten each of these four bolts.

Repeat these steps for both the Xa and Xb sides of the gantry.



Machine Software

Setting up the Computer for the EZ Cut

Operators can set up the software and other connection settings on the EZ Cut by setting up Windows, setting up the IP address, installing the sentinel system drive, connecting the machine to the computer, creating a category in the button bar, and cleaning up the desktop.

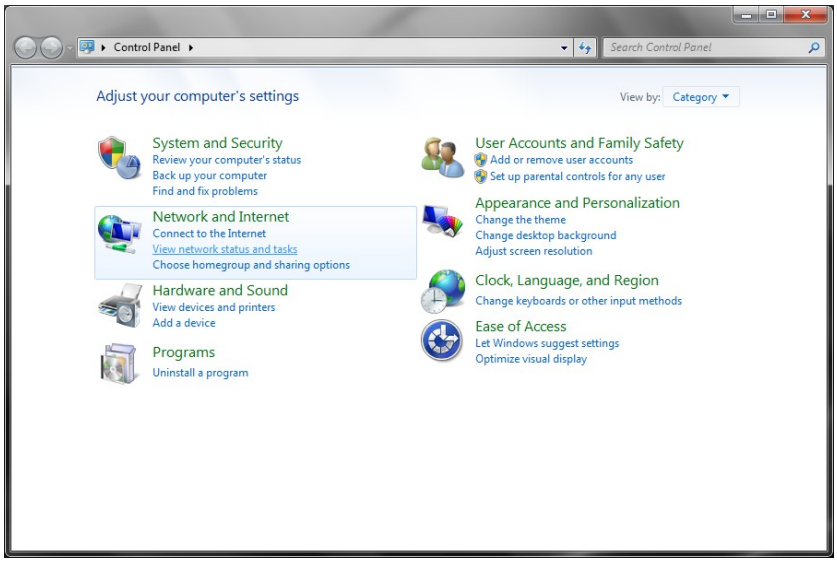
Setting up Windows

1. Turn on the computer.
2. Click *Next*.
3. Enter the name (e.g., Plasma) and click *Next*.
4. Click *Next* at the password dialog. No password should be entered on the manufacturing floor. Customers may choose to set up a password at a later date.
5. Click inside the checkbox to *I accept the license agreement for Windows*.
6. Click inside the checkbox to *I accept the license agreement to use the computer*.
7. Click *Next*.
8. Click to use the recommended settings.
9. Set the date and time.
10. Click *Next*.
11. Select Home Network as the computer location.
12. Wait for Windows to install. This may take a few minutes.
13. Leave the checkboxes blank and select *Finish*. The desktop will complete its setup.
14. Click *Next* twice.
15. Click *Finish*.

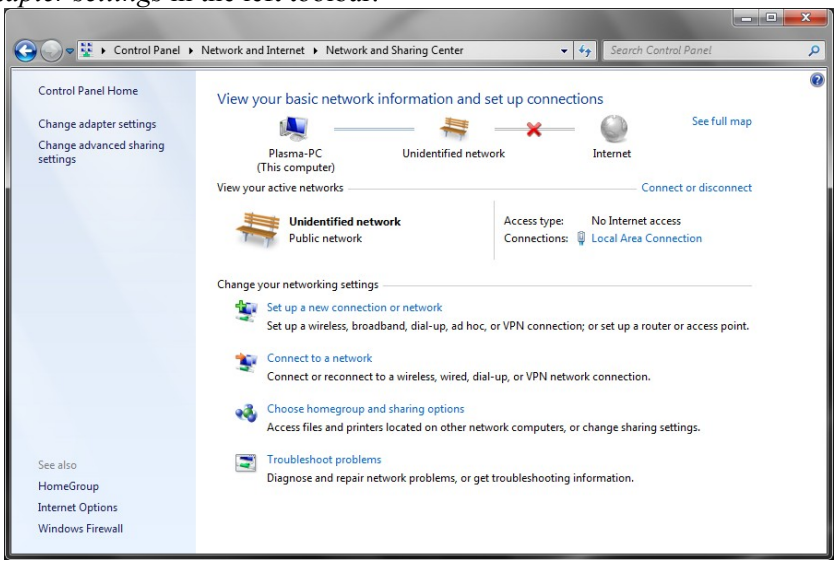
Setting Up the IP Address

1. Select Start > Control Panel. This will open a dialog.

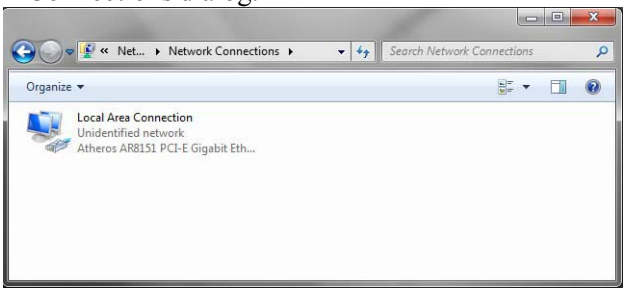
2. Locate Network and Internet and select *View Network Status and Tasks*.



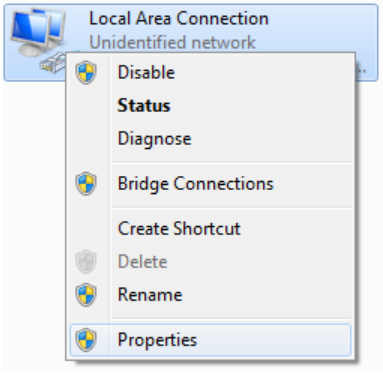
3. Select *Change adapter settings* in the left toolbar.



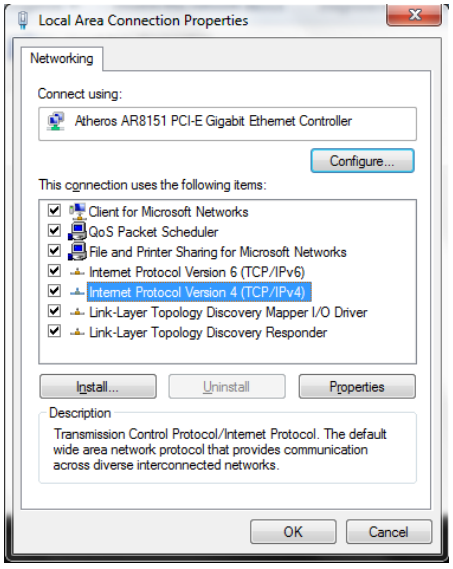
This will open the Network Connections dialog.



4. Right-click on Local Area Connection and select Properties.



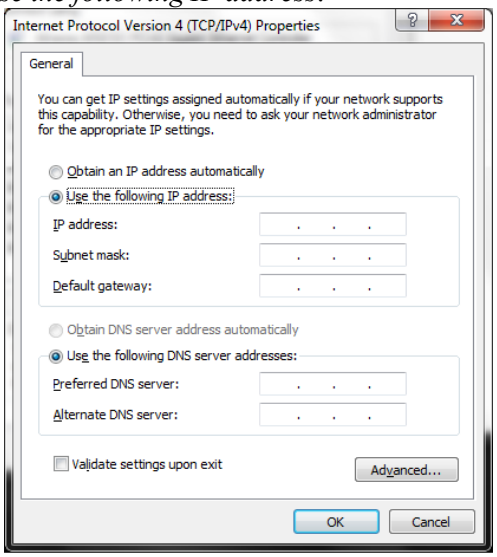
5. Scroll to and highlight Internet Protocol Version 4.



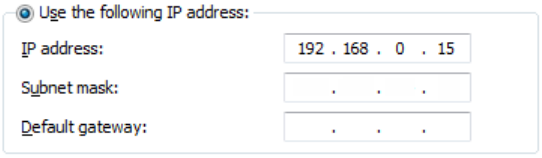
6. Click on 

. This will open the Internet Protocol Version 4 (TCP/IPv4) Properties dialog.

7. Click inside the circle next to *Use the following IP address*.

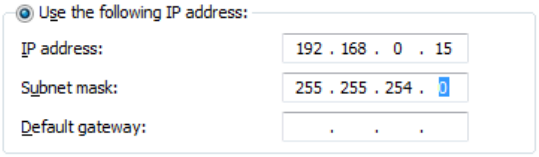


8. Enter the IP address as 192.168.10.XX where XX is the bay number in reverse (e.g., Bay 51 = 15).



9. Click inside the subnet mask. The address should auto-populate.

10. Set the address to 255.255.254.0 and select OK.



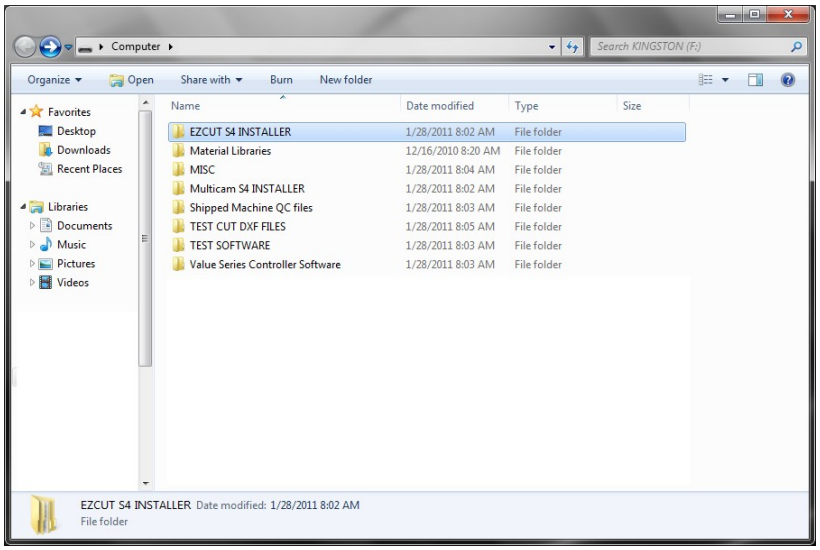
11. Close the Local Area Connection dialog and the Control Panel dialog.

12. Turn on the controller.

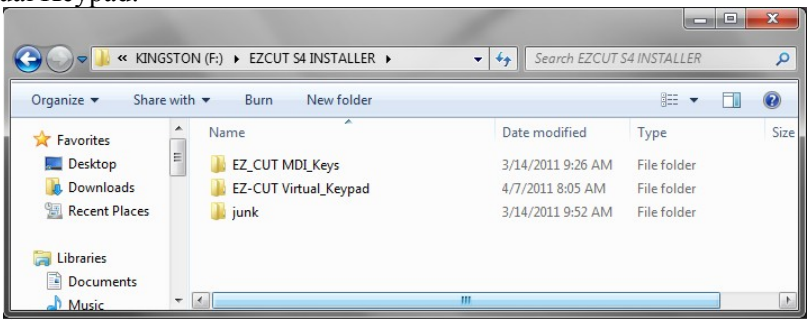
Installing the Sentinel System Drive

1. Open the software file. This will either be from a CD or a system loading dongle.

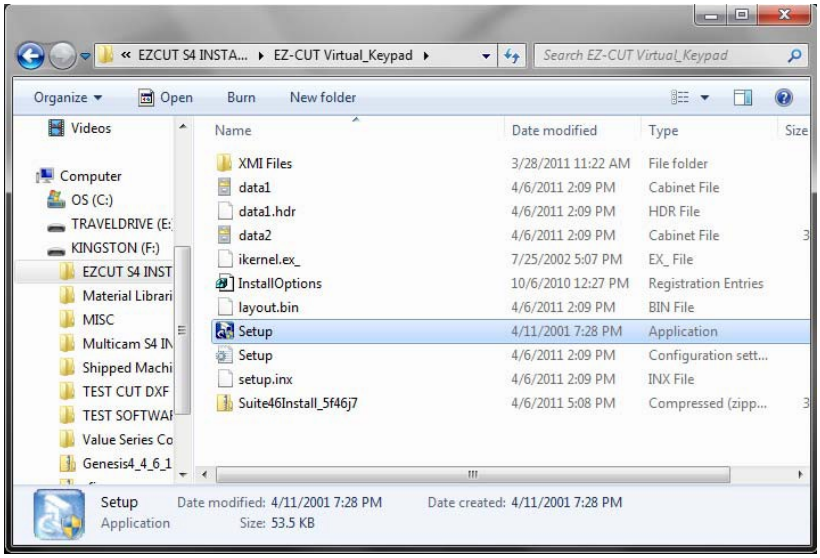
2. Open EZ Cut S4 Installer.



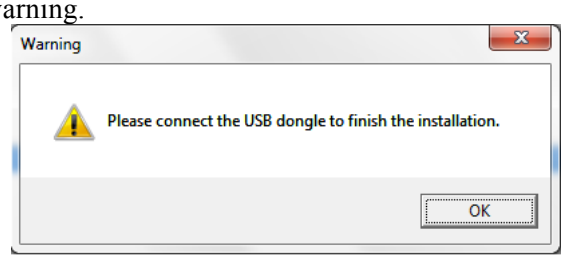
3. Open EZ Cut Virtual Keypad.



4. Open Setup.



5. Select OK at the warning.



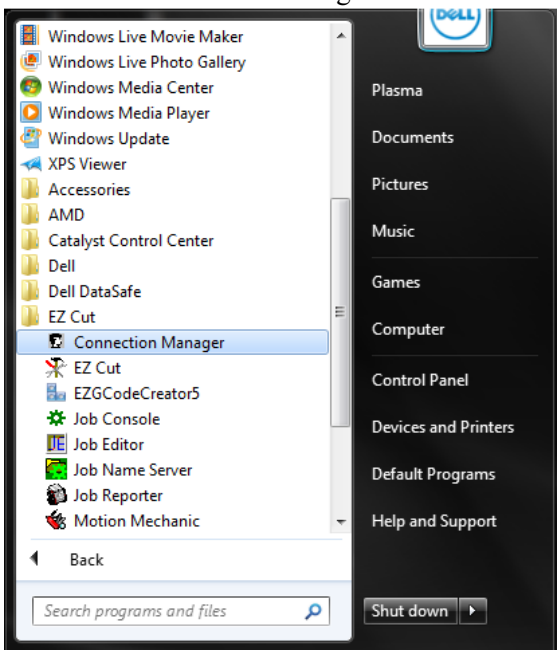
6. Move through the Install Shield Wizard following the prompts.

7. Select *Finish* to reboot. If the screen does not prompt for rebooting, then the operator should manually reboot the system.

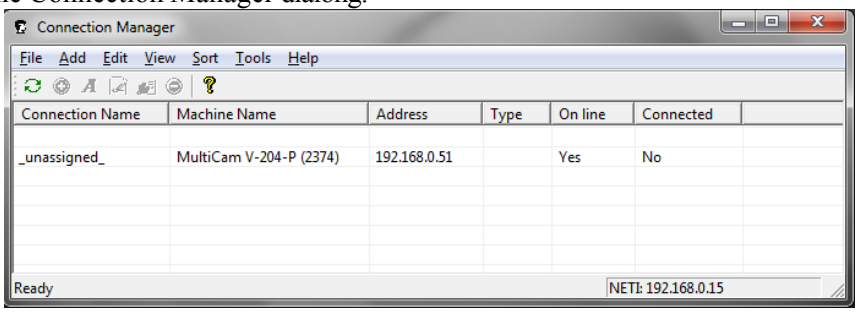
8. Close the McAfee Software dialog. This dialog appears after the system has been restarted.

Connecting the Machine to the Computer

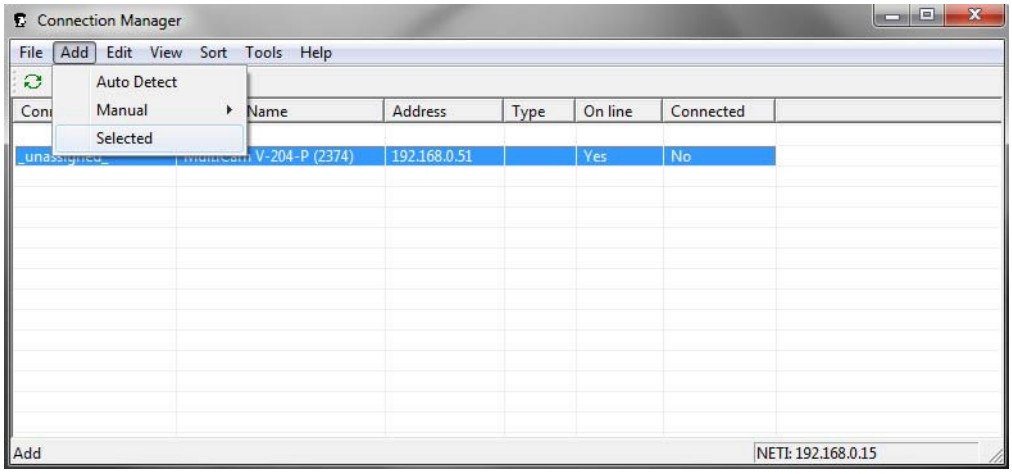
1. Select Start > All Programs > EZ Cut > Connection Manager.



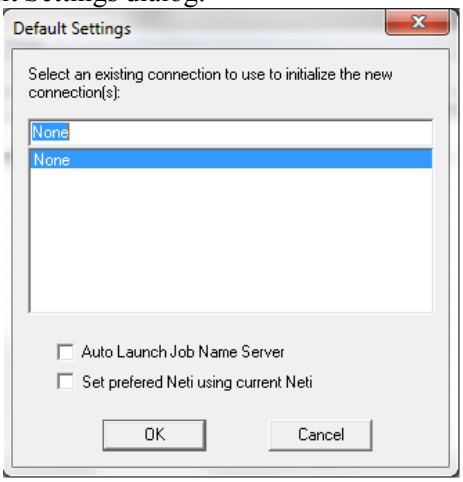
This will open the Connection Manager dialong.



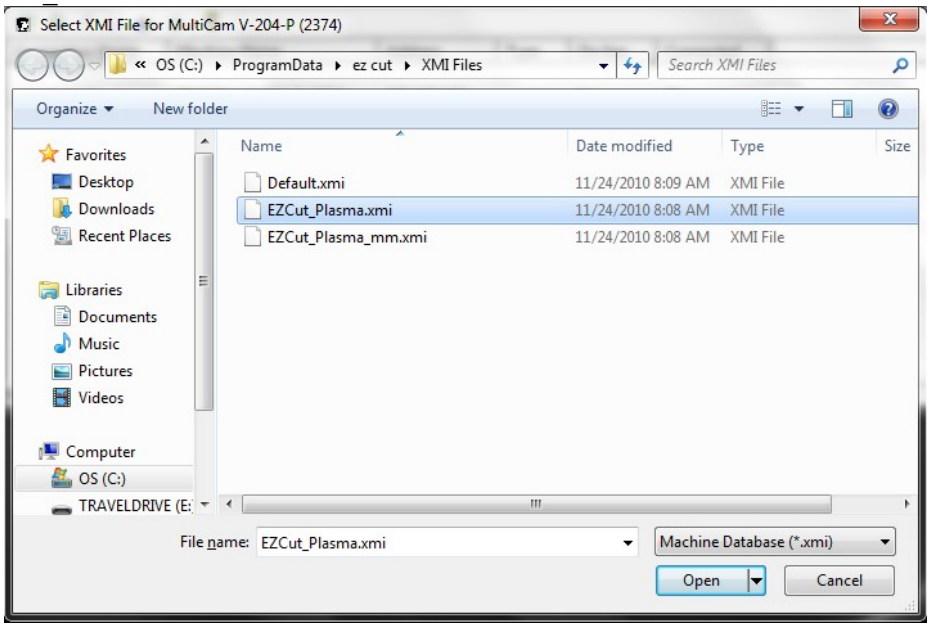
2. Highlight *_unassigned_* and select Add > Selected.



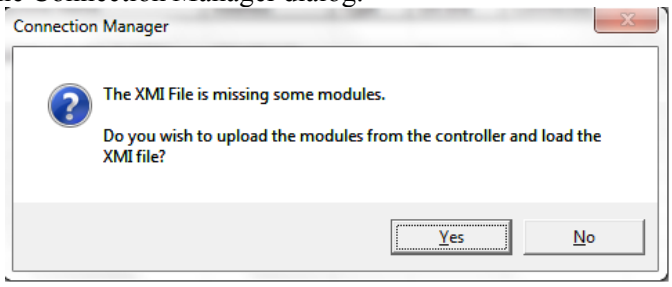
3. Select OK at the Default Settings dialog.



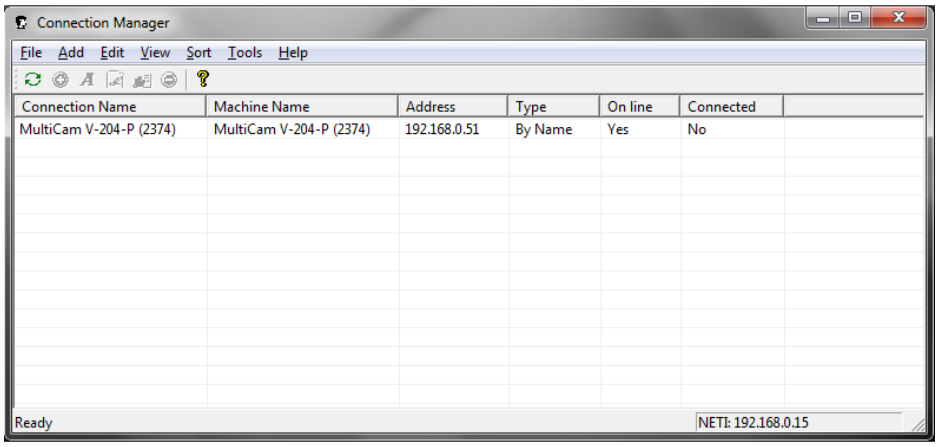
4. Highlight EZCut_Plasma.xmi and select Open.



5. Select Yes at the Connection Manager dialog.

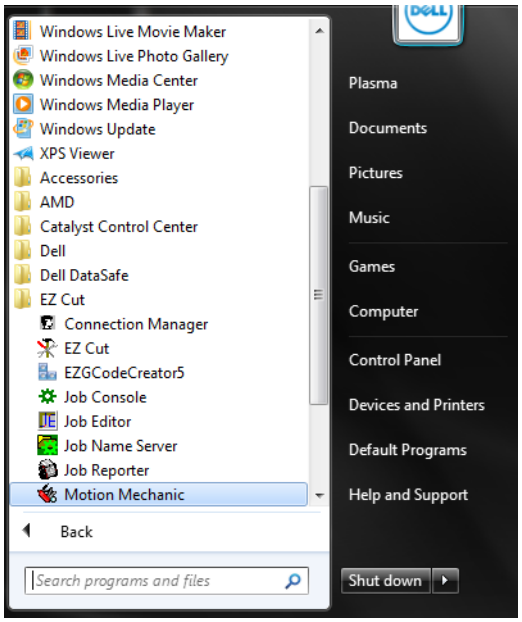


This will populate the connection name, which should match the machine name.



6. Close the dialog.

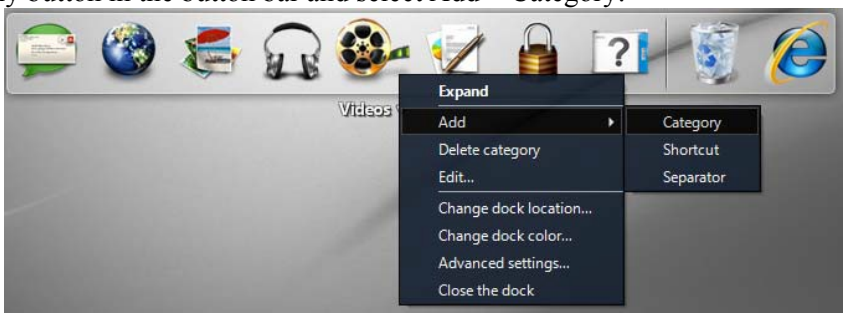
7. Select Start > All Programs > EZ Cut > Motion Mechanic.



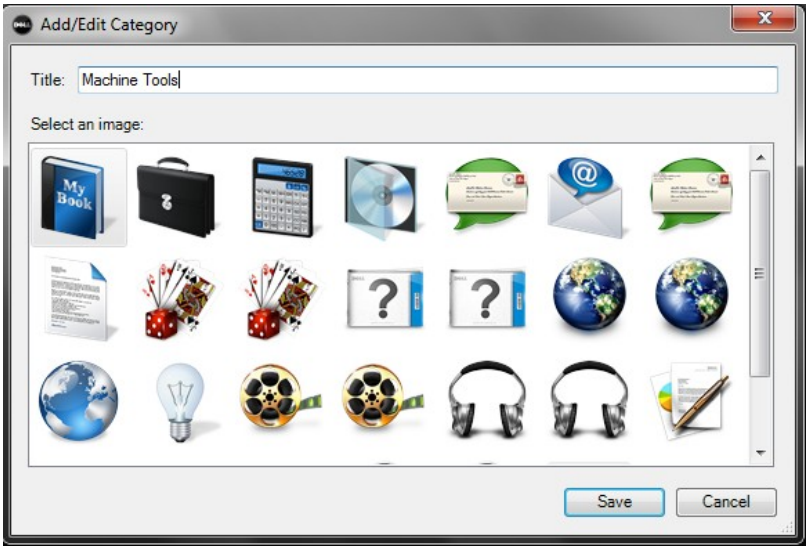
8. Press Enter twice. This verifies that a connection exists between the computer and the machine.

Creating a Category in the Button Bar

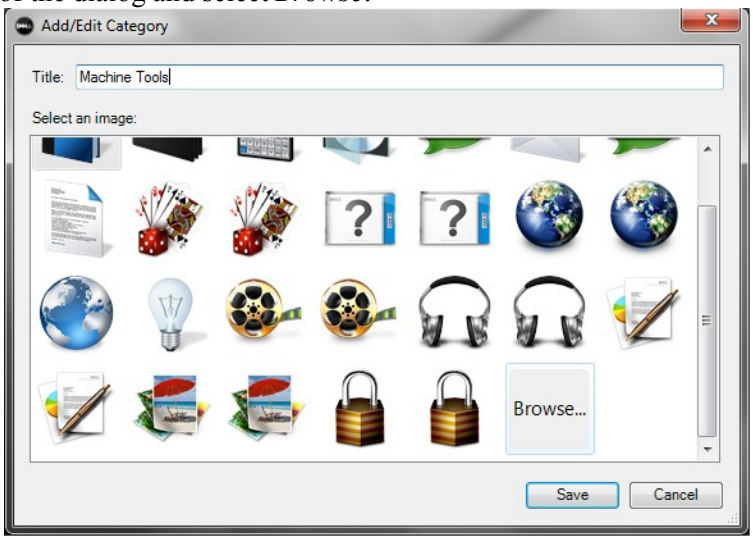
1. Right-click on any button in the button bar and select Add > Category.



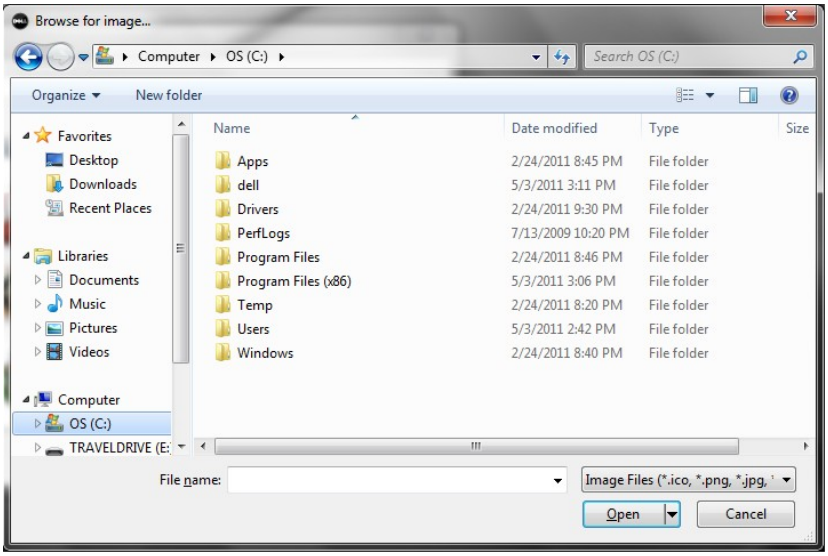
2. Enter the title as Machine Tools.



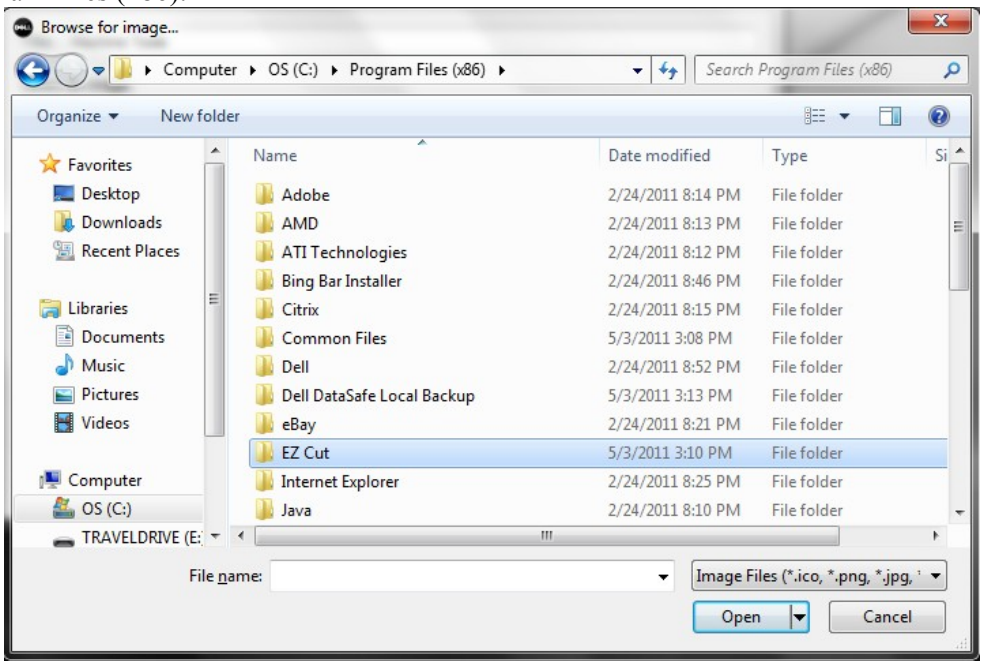
3. Scroll to the bottom of the dialog and select *Browse*.



4. Click on OS (C:) in the left toolbar.



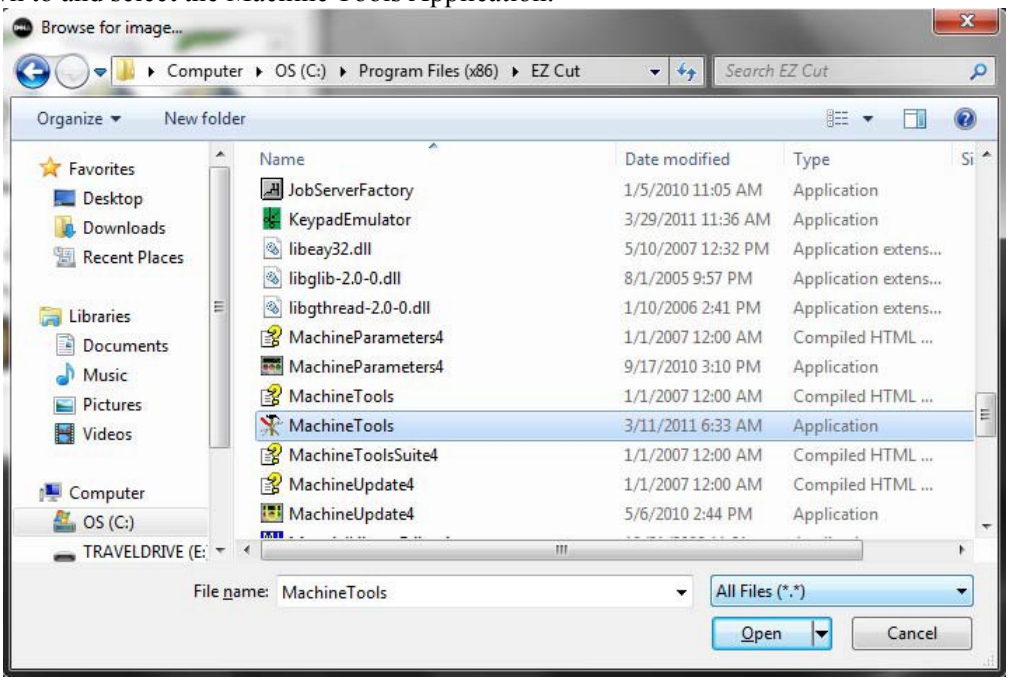
5. Open Program Files (x86).



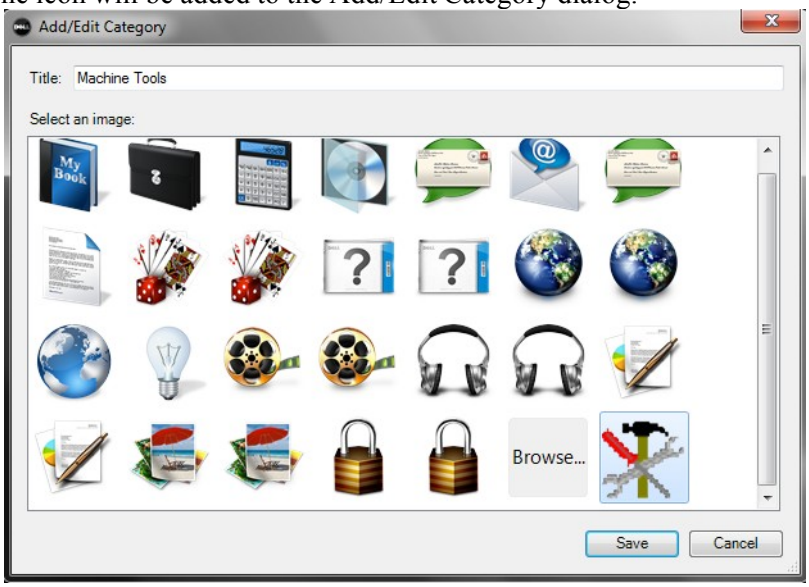
6. Open EZ Cut.

7. Change the file name type to All Files.

8. Scroll down to and select the Machine Tools Application.



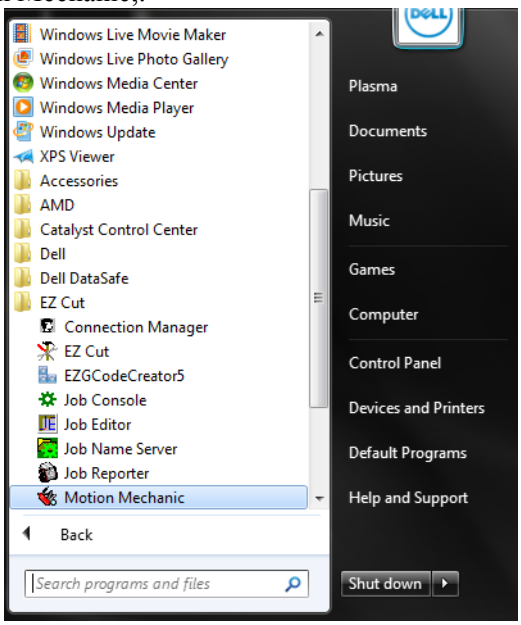
9. Click Open. The icon will be added to the Add/Edit Category dialog.



10. Select the icon and click Save. The icon will appear in the button bar.

Populating Machine Tools

1. Select Start > All programs > EZ Cut and highlight one of the following programs: EZGCodeCreator5, Job Console, Job Editor, Motion Mechanic,.



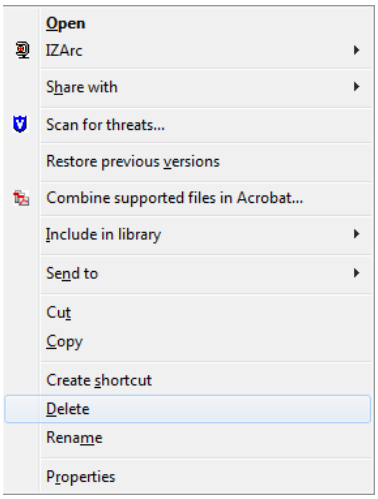
2. Right-click and carry it to the button bar.

3. Drop it on the Machine Tools icon.

4. Repeat steps 1 – 3 until all of the programs have been loaded under Machine Tools in the button bar.

Cleaning Up the Desktop

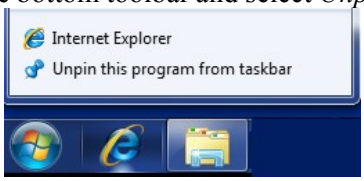
1. Highlight eBay and any other icons on the desktop, right-click, and select Delete. This will remove the icons from the main desktop.



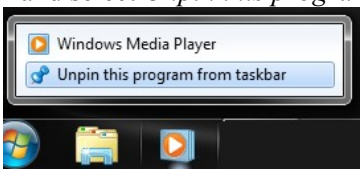
2. Right-click on a category in the button bar that is not Machine Tools or Recycle and select *Delete*.

3. Repeat step 2 for each category in the button bar, excluding Machine Tools and Recycle. All categories should be deleted individually.

4. Right-click on Internet Explorer in the bottom toolbar and select *Unpin this program from taskbar*.



5. Right-click on Windows Media Player and select *Unpin this program from taskbar*.



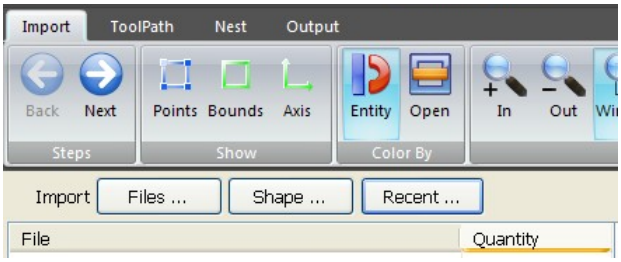
6. Review the desktop. There should be 2 categories in the button bar (i.e., Machine Tools and Recycle), the Start button, and one folder on the left side of the taskbar, and status icons and the clock with date on the far right side of the taskbar.

Start Up

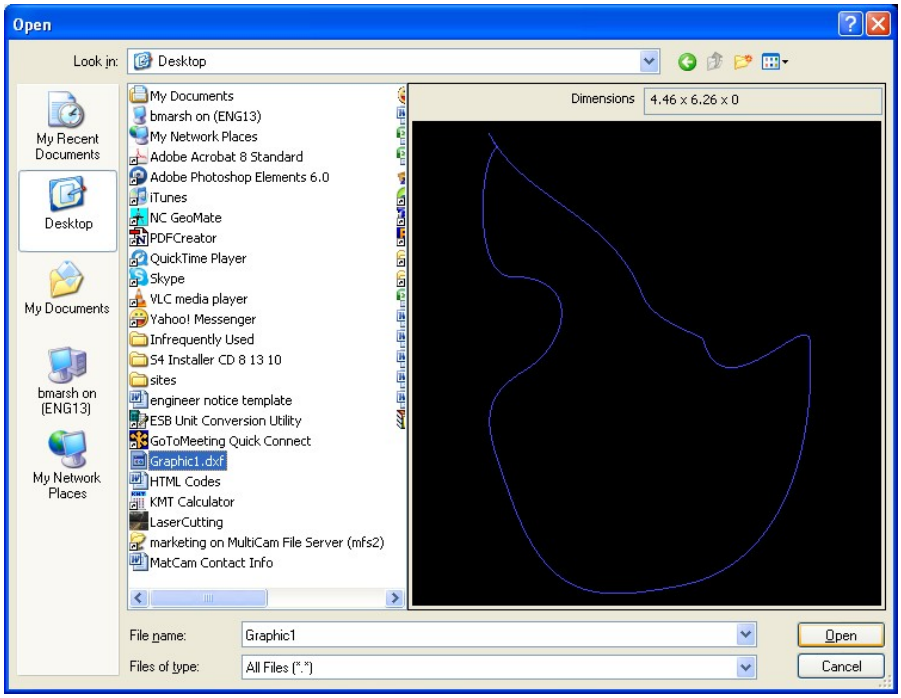
1. Turn on the computer, controller, and plasma.
2. Open Connection Manager.
3. Open Job Console and verify in Connection Manager that both columns (Online and Connected) say "Yes."
4. Open EZ G Code Creator.

Set Up EZ G Code Creator 5

1. Open EZ G Code Creator 5 and click on *Files* next to *Import*.



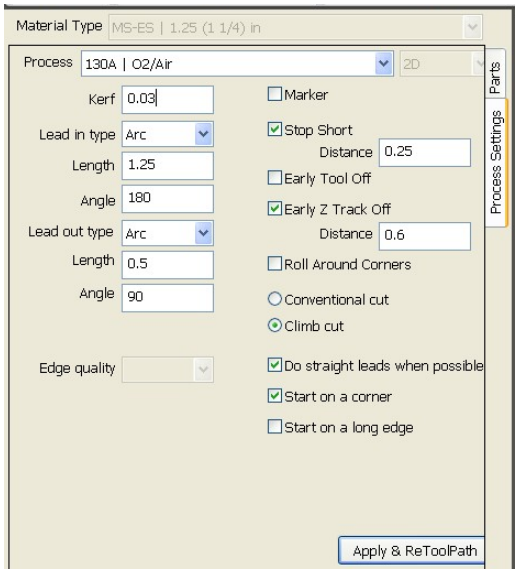
2. Browse to the job file and click on *Open*.



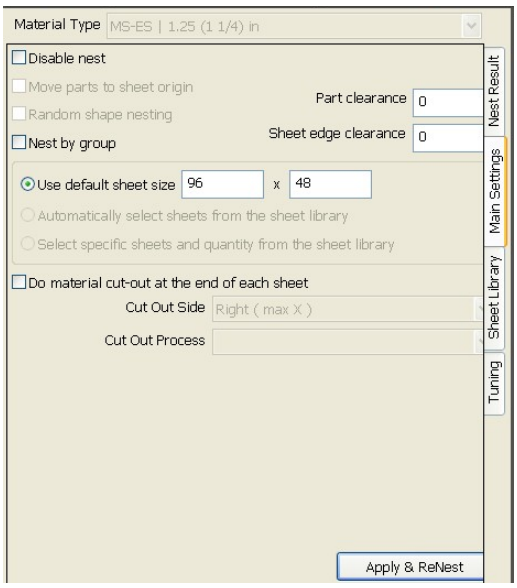
3. Locate the Defaults section at the bottom left.

Operators can make changes to the material or process by clicking on the Set Cut Parameters tab, clicking on Material Type and/or Process at the bottom, and making a change.

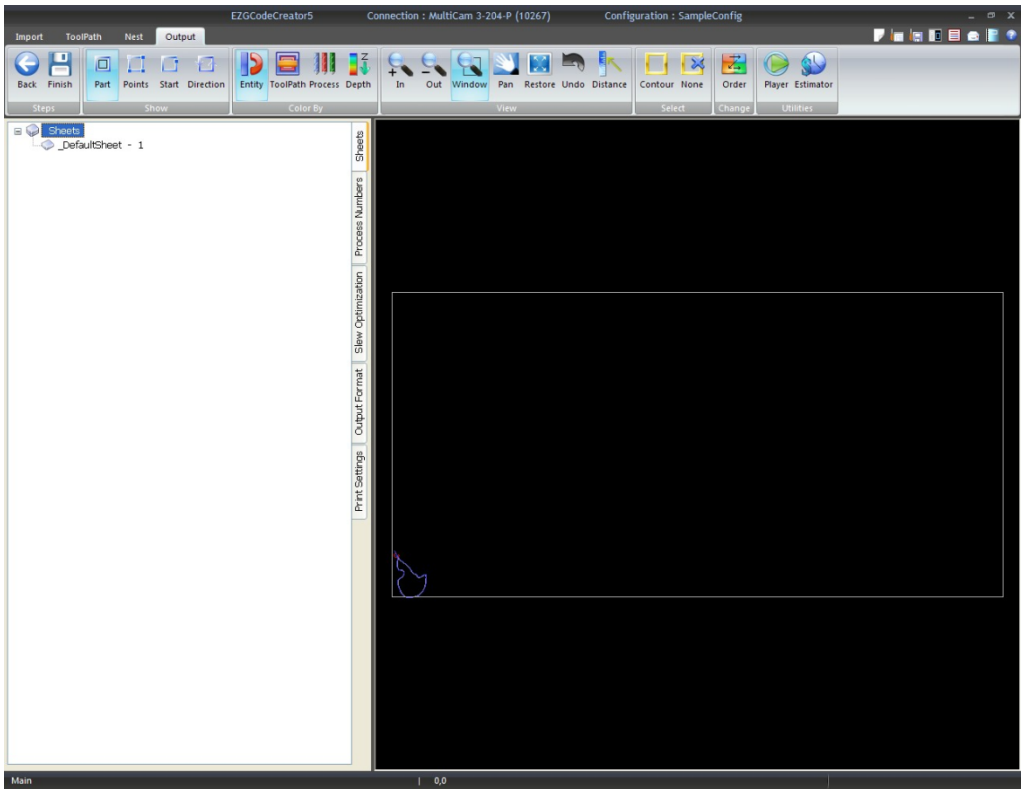
4. Click Next in the toolbar at the top and then click on the Process Settings tab.
   a. Change the kerf to 0.03. The kerf is the width of the arc.
   b. Set the different parameters for the cut: lead in, lead out, type of cut, etc.



5. Click Next, click on the Main Settings tab, and make any adjustments as necessary.

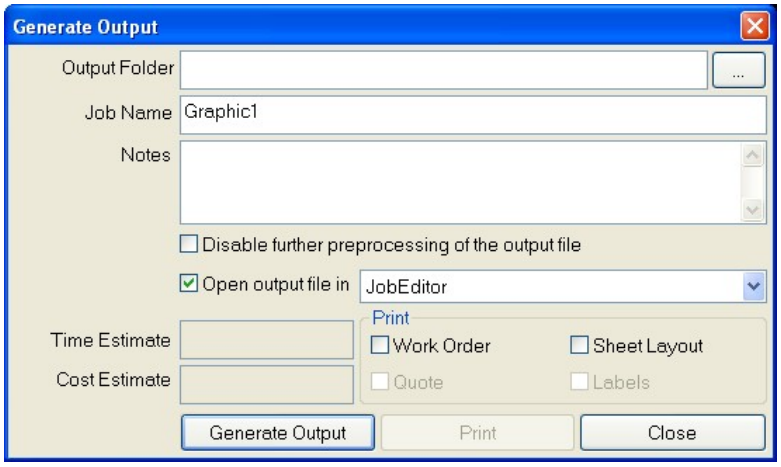


6. Click Next and review the job file.

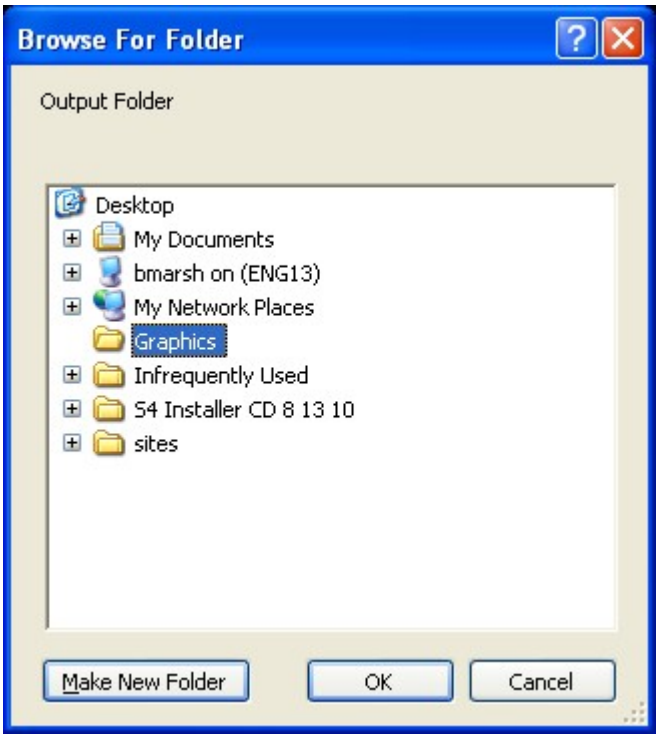


7. Click Finish.

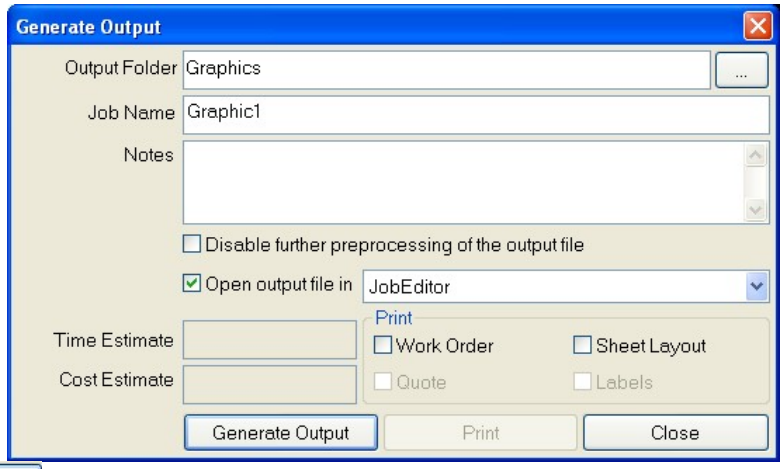
8. Add the job name to the Output file.

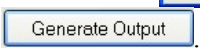


9. Click on the Browse button ... at the end of the text box next to Output Folder, select the folder in which the DXF should be saved, and click *OK*.



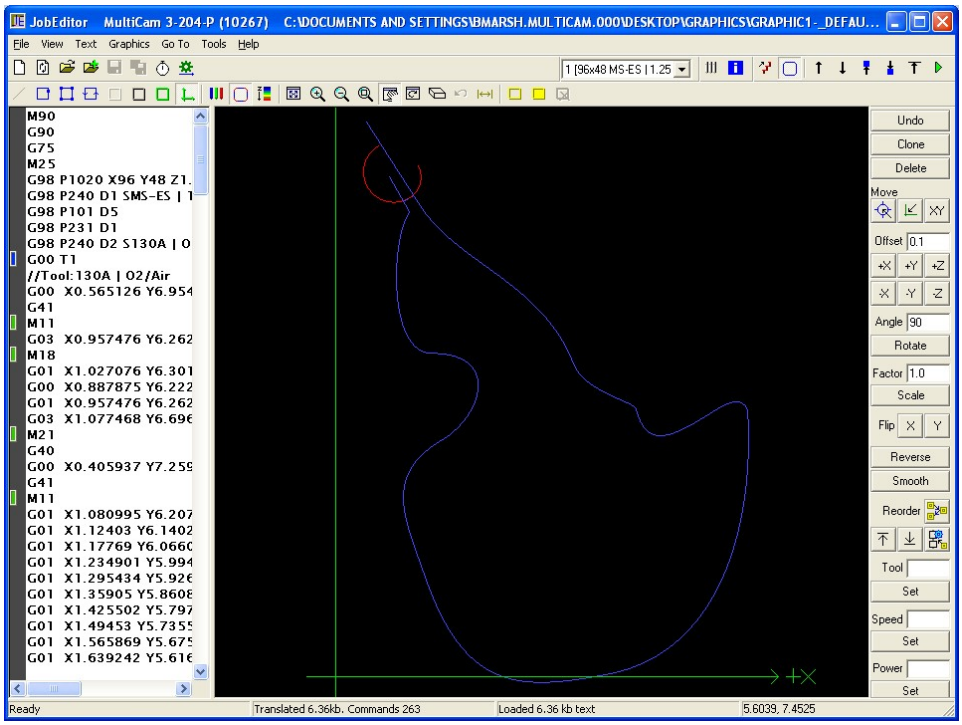
The folder name will be listed in the dialog.



10. Click on 

.

11. Review the file in preview and make any changes as needed.



12. Close the EZG Code dialog and return to JobConsole.

Execute the File

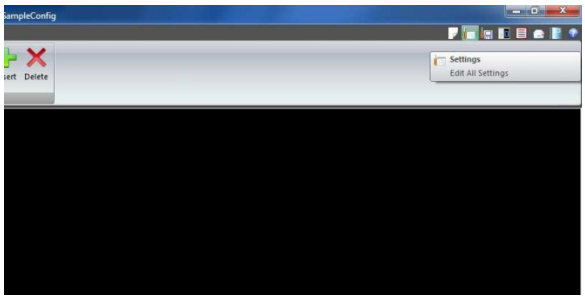
1. Open the job folder  in JobConsole and select the file.

2. Set Home  .

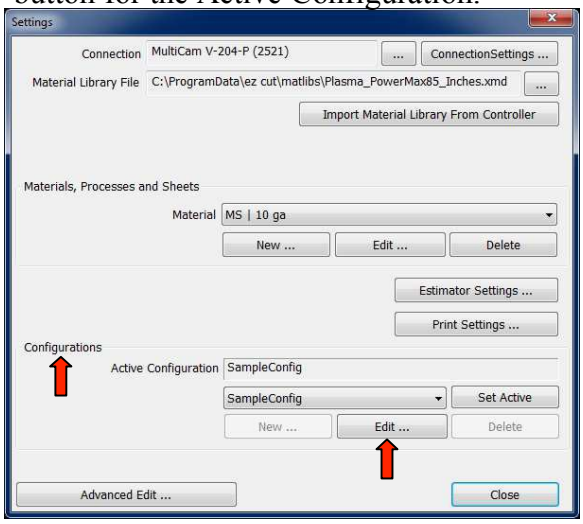
3. Click Play  in JobConsole or press the yellow button at the front of the machine.

Adding a Return to Home Command

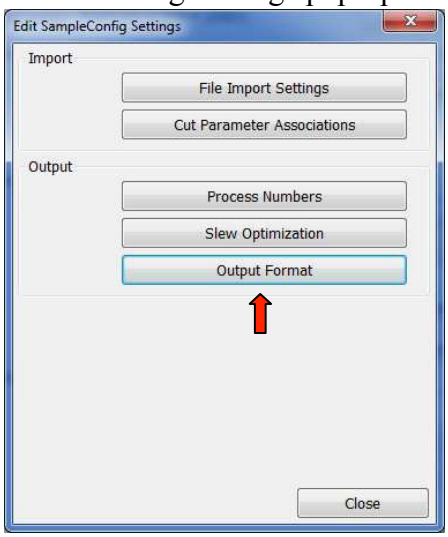
Open EZGCode Creator 5. Once open select the “Settings” icon in the upper right hand corner.



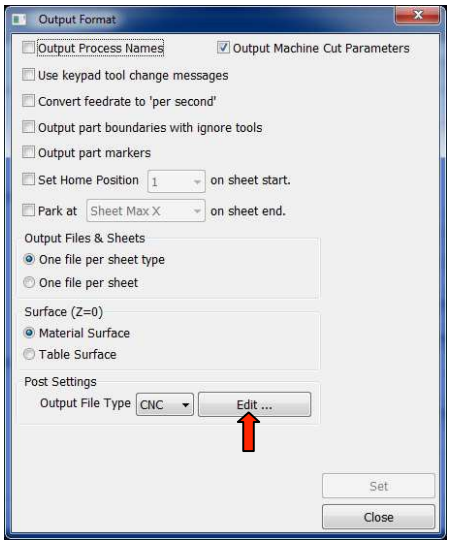
From the “Settings” pop-up screen find the “Configuration” section towards the bottom and select the “Edit” button for the Active Configuration.



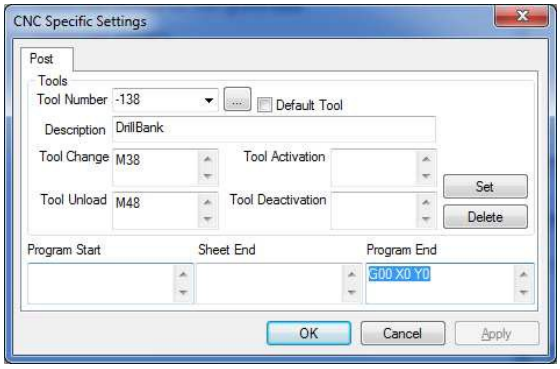
From the Edit Config Settings pop-up screen,



Once the “Output Format” screen pops up, locate the “Post Settings” section at the bottom and select the “Edit” button. Be sure the Output File Type is set to CNC.



In the “Program End” section of the CNC Specific Settings section enter the following into the box; G00 X0 Y0.



Press the OK button to return to the previous screen and Close on all the other open screens to return back to EZ G Code Creator. Press the “Save Setting” icon next to the previously mention “Settings” icon in the upper right hand corner. Now every time a new job is created, the output file will have the command to return the machine to the Home position where the job started.

Motion Controller Utilities

The software was developed to provide the operator more options and to interface with the newer Windows software. In addition to supporting the DNC function, the software also has options for digitizing, as well as JobReporter, bar code scanning, and tool diameter compensation. These tools are all written in 32-bit code and run directly from Windows 2000 or higher.

Suite4

 JobEditor

 ConnectionManager


MotionMechanic

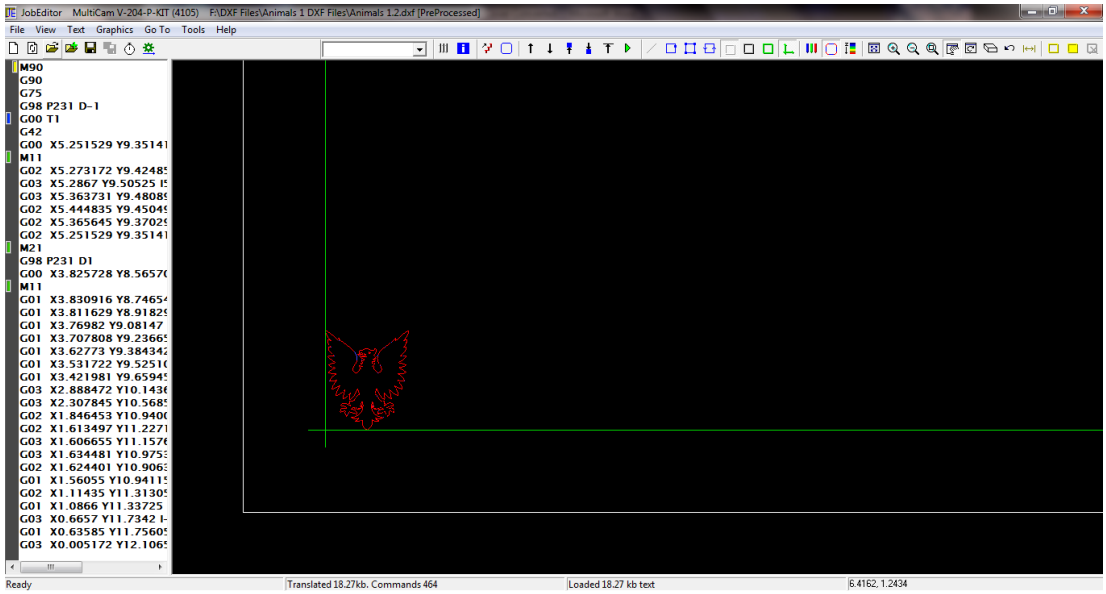
 JobConsole

Suite4 Motion Controller Utilities

Suite4 contains some additional features for standard PSS options and additional options with more advanced features. Operators can access additional information on these features in C:/Program Files/Machine Tools Suite4.

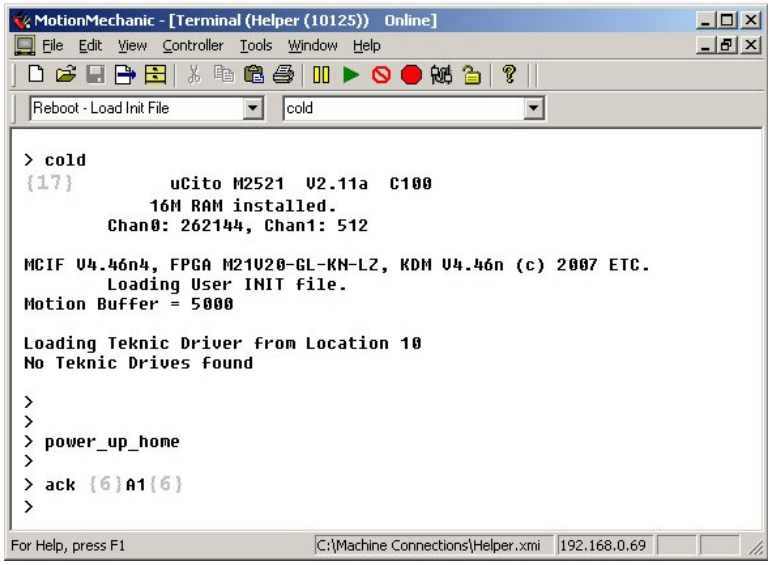
JobEditor

The Job Editor  application allows operators to preview and edit jobs through resizing, repositioning, or modifying current job files in any way.

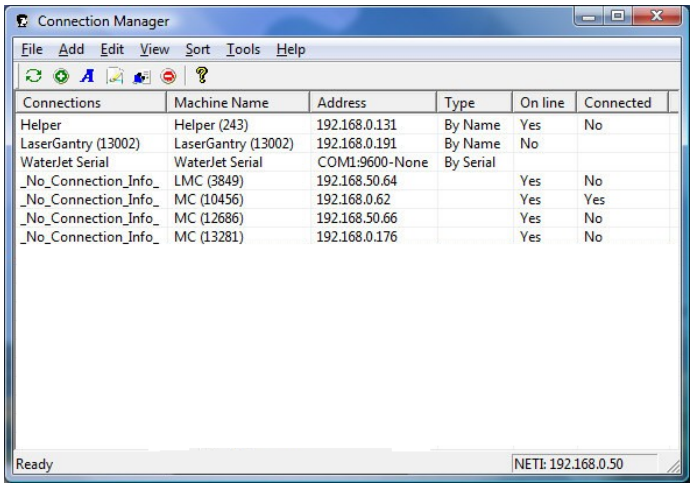

JobEditor MultiCam V-204-P-KIT (4105) F:\DXF Files\Animals 1 DXF Files\Animals 1.2.dxf [PreProcessed]
File View Text Graphics Go To Tools Help
M90
G90
G75
G98 P231 D-1
G00 T1
G42
G00 X5.251529 Y9.35141
M11
G02 X5.273172 Y9.4248
G03 X5.2867 Y9.50525 I
G03 X5.363731 Y9.4808
G02 X5.444835 Y9.4504
G02 X5.365645 Y9.3702
G02 X5.251529 Y9.35141
M21
G98 P231 D1
G00 X3.825728 Y8.5657
M11
G01 X3.830916 Y8.7465
G01 X3.811629 Y8.9182
G01 X3.76982 Y9.08147
G01 X3.707808 Y9.2366
G01 X3.62773 Y9.38434
G01 X3.531722 Y9.5251
G01 X3.421981 Y9.6594
G03 X2.888472 Y10.143
G03 X2.307845 Y10.568
G02 X1.846453 Y10.940
G02 X1.613497 Y11.227
G03 X1.606655 Y11.157
G03 X1.634481 Y10.975
G02 X1.624401 Y10.906
G01 X1.56055 Y10.9411
G02 X1.11435 Y11.3130
G01 X1.0866 Y11.33725
G03 X0.6657 Y11.7342 I-
G01 X0.63585 Y11.7560
G03 X0.005172 Y12.106
Ready
Translated 18.27kb, Commands 464
Loaded 18.27 kb text
6.4162, 1.2434

MotionMechanic

The MotionMechanic application provides the operator with advanced technical control over the use and setup of the motion controller from a host PC.

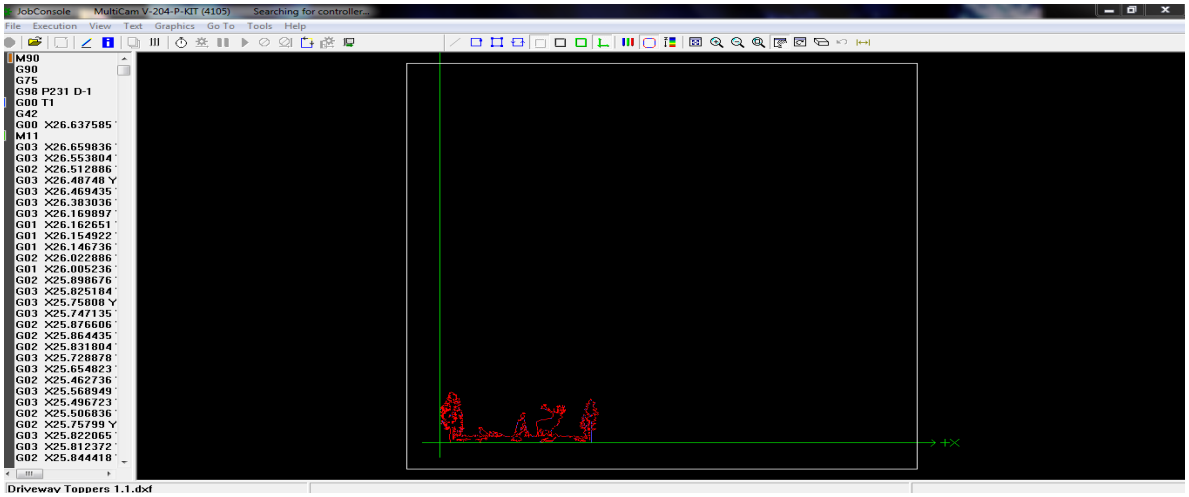


The ConnectionManager  helps in creating and configuring the connection between a host PC and the machine tool and has built-in testing features for diagnosing communications issues and sending email correspondence for assistance. Operators can also establish one particular computer to be in charge of all communications, which is helpful if multiple computers are connected to a machine.



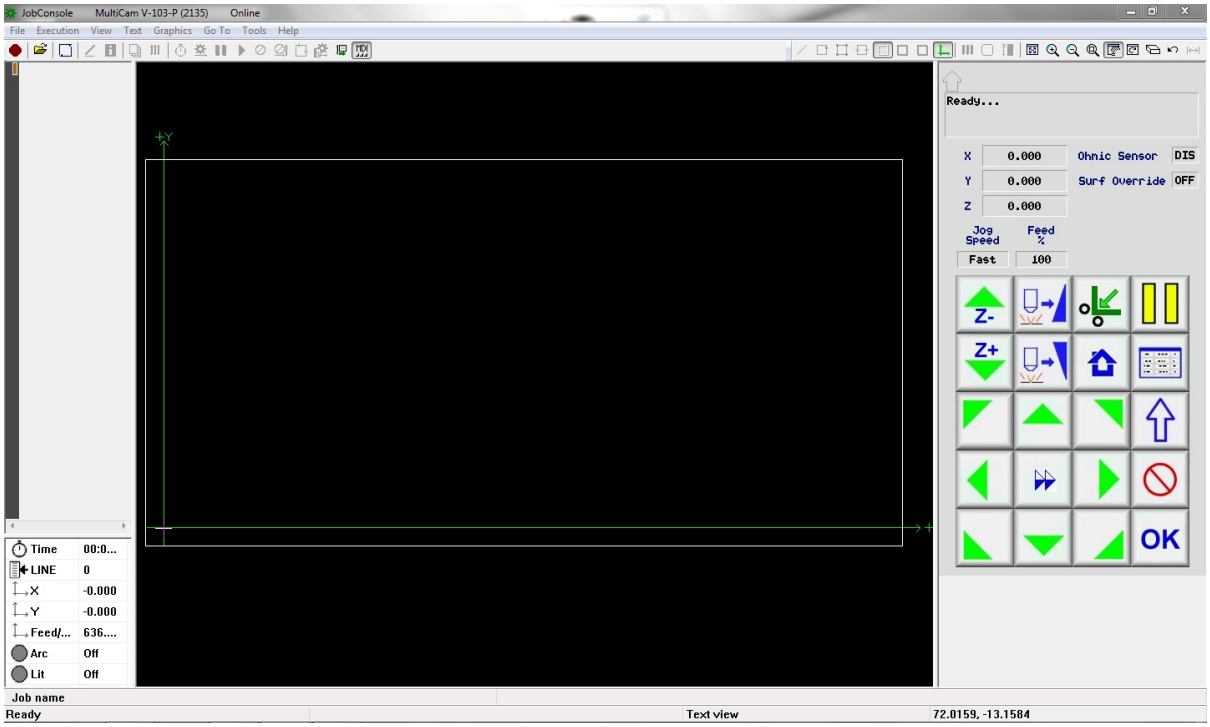
JobConsole

The JobConsole  program acts as the main graphical interface between a machine tool and the operator, allowing the operator to preview and execute jobs as well as monitor the job progress, pause and resume the job, move to a specific point in the job, and move through the job a single cut at a time.



Virtual Keypad

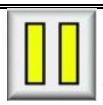
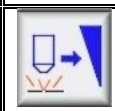
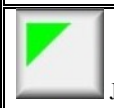
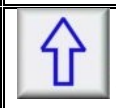
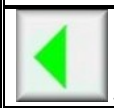
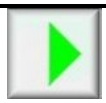
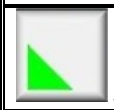
The ***MultiCam*** JobConsole Virtual Keypad allows the operator to establish Home, override the feedrate, check the machine information, move the cutting head, and start cutting from the computer screen. The motion of the machine and the cut file are both represented on the computer in JobConsole.



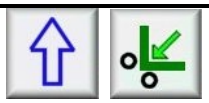
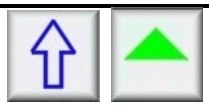
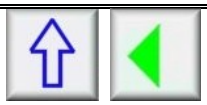
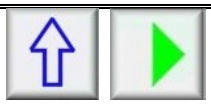
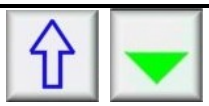
The icons in the toolbar allow the operator to modify the cutting file.

	Stop Motion / E-stop		Execute from Current Sheet
	Open Job		Pause Job Execution
	Refresh Machine Runtime Parameters		Continue Job Execution
	Edit Job		Cancel Job
	Show / Hide Properties		Stop on Next Marker
	Show / Hide Sheet Filter		Move Along Job
	Show / Hide Tool Filter		Execute from Current Position
	Estimate Execute Time		Default Material and Process

The virtual keys used to operate the machine are identified below.

 Z Up	 Feedrate Increase	 Go Home	 Pause
 Z Down	 Feedrate Decrease	 Set Home	 Information
 Jog 45°	 Jog 360°	 Jog 315°	 Shift
 Jog 90°	 Jog Speed	 Jog 270°	 Cancel
 Jog 135°	 Jog 180°	 Jog 225°	 OK

The Shifted virtual keys are identified below.

		 Find Home	
			 Park Z
	 Park X High		
 Park Y High		 Park Y Low	
	 Park X Low		

Z Up and Down

The Z Up and Down function allows the operator to adjust the Z height of the cutting head.

1. Open JobConsole.

2. Click on Z Up 

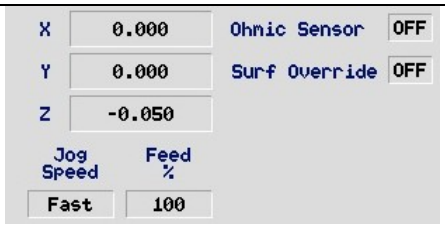
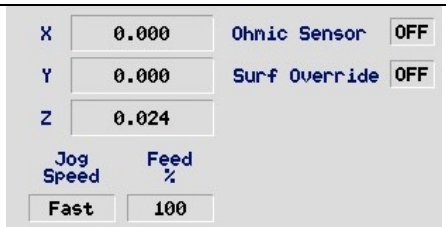
or Z Down 

.

Z Up 

raises the cutting head above the table while Z Down 

lowers the cutting head to the table.

Z Up = Negative Direction	Z Down = Positive Direction
	

Operators can park the Z by clicking Shift  and Z Up 

.

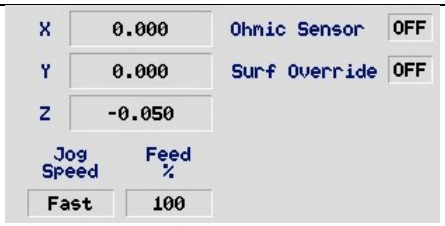
Feedrate Override

The Increase/Decrease Feedrate function allows the operator to override the feedrate during a cutting sequence.

1. Open JobConsole.

2. Open a file and begin cutting.

3. Click on Increase Feedrate  or Decrease Feedrate  to change the feedrate during a cutting file*. The percentage increased or decreased will be shown on the virtual keypad.

	
Feedrate at 100%	Feedrate at 75%

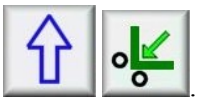
* If the Automatic Torch Height Control (ATHC) is active, then the virtual Feedrate Override buttons will be grayed out. No feedrate override is possible if the ATHC is on. Operators may check Main Menu > Settings to determine the status of the ATHC.

Go Home

The Go Home function allows the operator to move the cutting head to the last set Home location.

1. Open JobConsole.
2. Click on Go Home  . The cutting head will move to the last set Home location.

Operators can access the Find Home function by pressing Shift  and Go Home  . This locates the 0,0 and should be selected after the machine is powered up. Finding Home will orient the cutting head to the proper starting position.

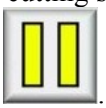
1. Open JobConsole.
2. Click on Find Home  . The cutting head will find 0,0 and then move to the last set Home location.

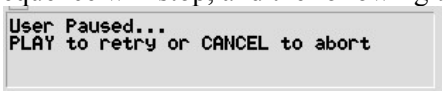
Pause

The Pause function allows the operator to temporarily halt the cutting sequence. This virtual button works in conjunction with the Pause/Play button at the front of the machine.

1. Open JobConsole.

2. Open and run a cutting sequence.

3. Click on Pause  . The cutting sequence will stop, and the following text will be visible on the virtual keypad.



Operators may either press Play  in the JobConsole toolbar to continue the cutting sequence or Cancel  to end the cutting sequence.

Set Home

The Set Home function allows the operator to establish a Home location for the cutting sequence. Any time the operator selects Go Home or Find Home, the cutting head will reorient itself to the front right corner of the machine and then move to the Set Home location.

1. Open JobConsole.

2. Click on the directional arrow(s) needed to move the cutting head to the desired Home location.

3. Click on Set Home  to set a Home location.

Main Menu

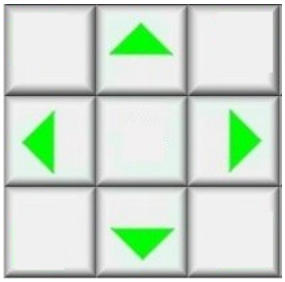
The Main Menu function allows the operator to review the system information about the machine and make changes if needed. This information can be helpful during diagnostics.

1. Open JobConsole.

2. Click on Main Menu  .

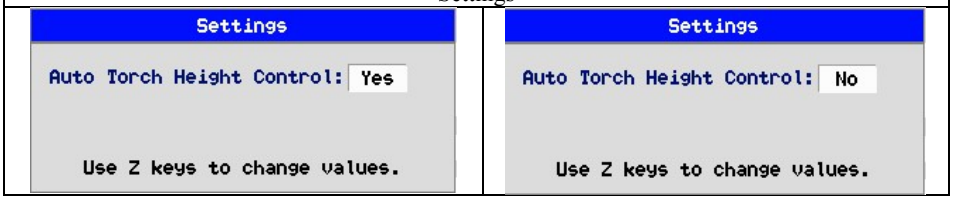
3. Review the Main Menu.

4. Click a directional arrow to reach the specific topic for information. Only the traditional directional arrows will move the highlighted area.

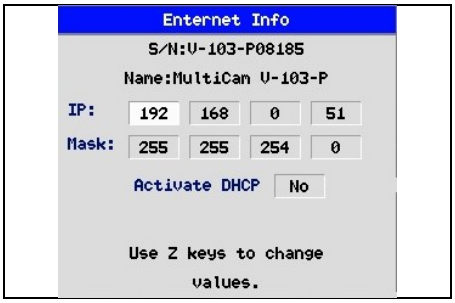


5. Click on OK  when the specific topic for information is highlighted. This information will be unique to each machine. Operators can review the Settings or Ethernet Settings information under each menu item and make changes as needed from the sub-menu.

Settings

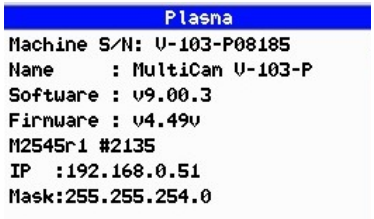


Ethernet Settings

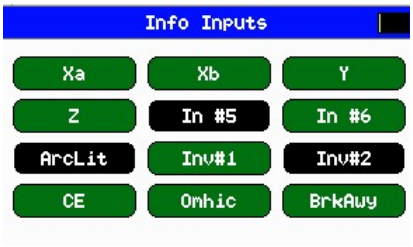


Operators who select the Information menu item will begin at the Machine Information screen and may access other machine-specific information by clicking specific virtual keys as shown below.

1. Click Go Home  , Increase Feedrate  , Decrease Feedrate  , or Set Home  to access machine-specific information.
2. Click Cancel  between screens and then press Cancel  twice to exit the Information sub-menu.



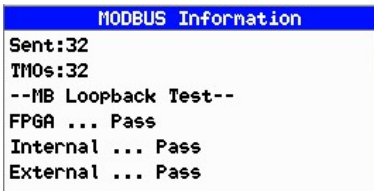
Info Inputs



Each box shows the status of the specific input.

- Dark = off
- Bright = on

MODBUS Information



"MODBUS Information"
Packets Sent
Timeouts
"MP Loopback Test"
FPGA
Internal
External

Power Information

"Power Information"
Incoming 24V Power to the Board
"Recorded Power"
"Glitches"

PCB Temperature

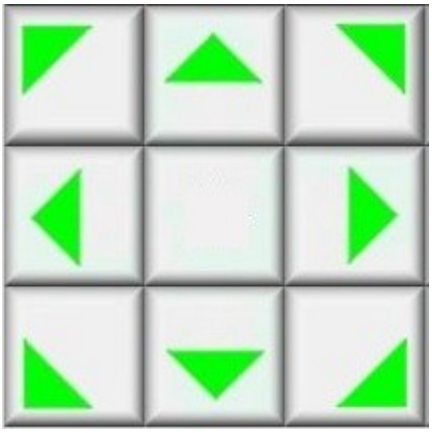
"PCB Temperature"
Temperature of the PCB

Directional Arrows

The Directional Arrows allow the operator to move the cutting head in 45, 90, 135, 180, 225, 270, 315, and 360-degree increments.

1. Open JobConsole.

2. Click on a directional arrow to move the cutting head.



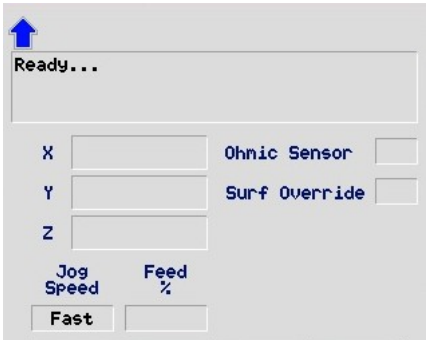
Operators can park the gantry or carriage at the high and low set positions of each axis by selecting the following virtual buttons:

- X-axis High by clicking on Shift  and X-axis Up 
- X-axis Low by clicking on Shift  and X-axis Down 
- Y-axis High by clicking on Shift  and Y-axis Left 
- Y-axis Low by clicking on Shift  and Y-axis Right 

Shift

The Shift function allows the operator to access the shifted functions available on the virtual keypad.

1. Open JobConsole.
2. Click on  . The arrow outline at the top of the virtual keypad will fill in.



3. Click on one of the virtual buttons to access the shifted features associated with that button. Not all virtual buttons will have shifted features.

Jog Speed

The Jog Speed function allows the operator to change the Jog speed from slow to medium to fast to slow again.

1. Open JobConsole.
2. Activate motion.
3. Click on Jog Speed  to change the Jog speed from slow to fast or back. The speed will show in the dialog.

Cancel

The Cancel function allows the operator to exit a screen.

1. Open JobConsole.

2. Open a feature or review a setting as needed.

3. Click on Cancel  once to exit the feature and return to the previous screen or twice to return to the virtual keypad.

OK

The OK function allows the operator to accept an input value.

1. Open JobConsole.

2. Make a selection from the virtual keypad.

3. Click on OK 

to accept the value.

Play/Pause and E-Stop

The Play/Pause and E-Stop buttons at the front of the machine allow the operator to run, pause, or halt a job file from the machine rather than at the computer.

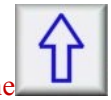
Operators may press the E-Stop button to halt all cutting and motion sequences at any point during the cutting process.

Operators may push the yellow button to run the job file at the beginning of the sequence or if the machine is in Pause mode.
Operators may push the yellow button to pause the job file while the cutting sequence is in progress.

Fast Start EZ Cut

1. **Turn on Power**
Locate the power switch, the round knob located on the control enclosure.
Rotate to the ON position.
Press the power button on the computer. JobConsole should automatically start once the computer is turned on.

2. **Find Machine Hard Home**

Click on Find Home  and then  to find the Hard Home 0,0 or the Machine Home by indexing the gantry, carriage, and Z assembly off of the proximity (limit) switches.

3. **Set Home**
Click on the directional arrows to place the **center of the head assembly** over the Home location.

Click on Set Home  to set Home for the head assembly.

4. **Access Job File**

Click on Open Job  in the toolbar, locate the cut file, and open the file.

Click on Execute from Current Sheet  in the toolbar.

1. **Start / Cancel / Pause**

   Click on Play  to begin the cutting sequence or press the yellow button at the front of the machine.

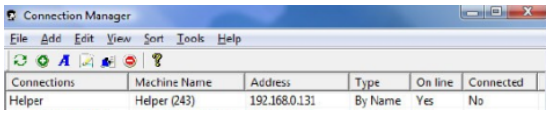
   Click on Pause  to yield the cutting sequence or press the yellow button at the front of the machine.

   Click on Cancel Job  to abort the cutting sequence. Operators can only cancel a job using this feature when the cutting sequence is in pause mode.

   Operators should never leave the machine unattended during the cutting sequence.

Training

Connection Manager 

1. Open Connection Manager 

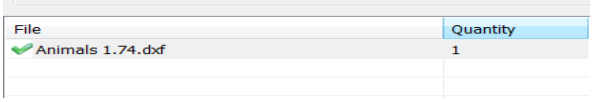
– On-Line is YES and Connected is YES

Motion Mechanic 

1. Open Motion Mechanic, and hit f6 to get a <, then type qc, and press enter
2. **Set following flash parameters** exactly as they are entered in the previous qc:
    a. 9 – set to table cutting size (x-axis)
    b. 10 – set to table cutting size (y-axis)
    c. 261 and 262 – set to 30.00
    d. 1091 and 1092 – set to 60.00
3. After the qc is complete, hit CTRL+A, then CTRL+C, and paste contents into Notepad document and save it to your desktop
4. To view all cut parameters, hit f6 to get a <, then type show, and press enter
5. To reboot the software to its default settings, hit f6 to get a <, then type cold, and press enter
6. **CAUTION: Do not change any variables in Motion Mechanic unless you are instructed to do so by a representative of EZ Cut CNC. If you change parameters in Motion Mechanic, YOU ARE RESPONSIBLE.**

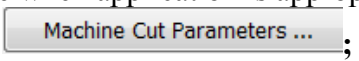
EZ G-Code Creator 

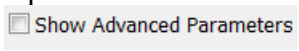
1. IMPORT is first page of Creator
    a. Set material type and process 

    b. Go to Files and select file you are going to cut
    c. Set quantity 

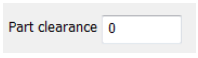
    d. Click NEXT 

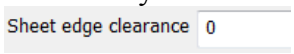
2. TOOL PATH is second page of Creator
    a. Set Kerf from plasma cutter operating manual
    b. Set Lead In type & angle
    c. Set Lead-Out –only on material thicker than 0.5”
    d. Stop Short – if cutting large quantity of smaller parts
    e. Early Tool Off
    f. Early Z Track Off

g. Roll Around Corners
h. Always check Do straight leads when possible
i. Always check Start on a corner
j. Only check Start on a long edge when application is appropriate
k. Open Machine Cut Parameters 

; open advanced


i. Set Feedrate
ii. Set Cut Height
iii. Set Pierce Delay
iv. Set Voltage
v. Set THC Delay
vi. Set Max Volt Gap – Always 50
vii. Set Sample THDC
viii. Set Use Thin Coef
ix. Close
x. Click NEXT 

3. Nest is the third page of Creator
   a. Put dimension in Part Clearance 

if you have multiple parts
   b. Put dimension in Sheet Edge Clearance 

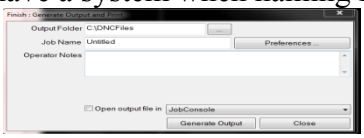
   c. Put dimensions in sheet size – x is first, y is second 

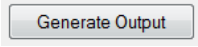
   d. If necessary change start points 

   e. Click NEXT 

4. OUTPUT is the last page of Creator
   a. Click Finish 

   b. Choose Output Folder 

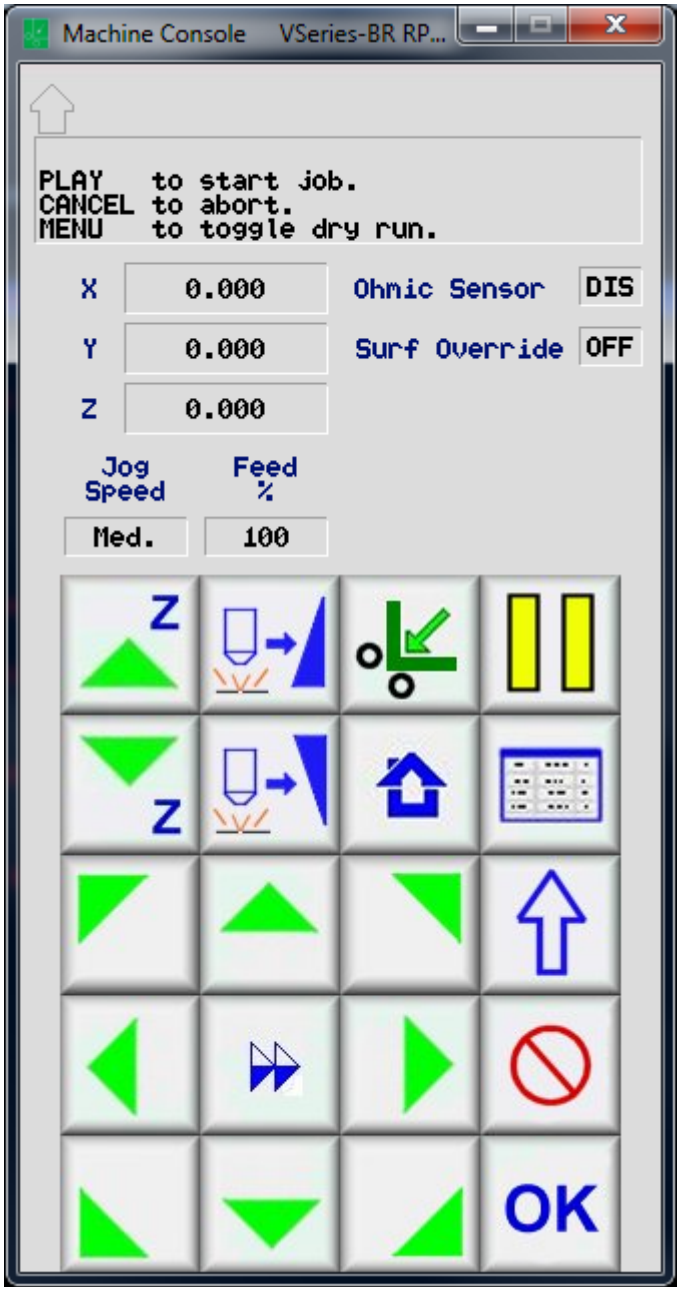
   c. Type in the name of the file. It is important to have a system when naming DNC files.
   d. De-select box that is titles Open Output File In 

   e. Click on GENERATE OUTPUT 

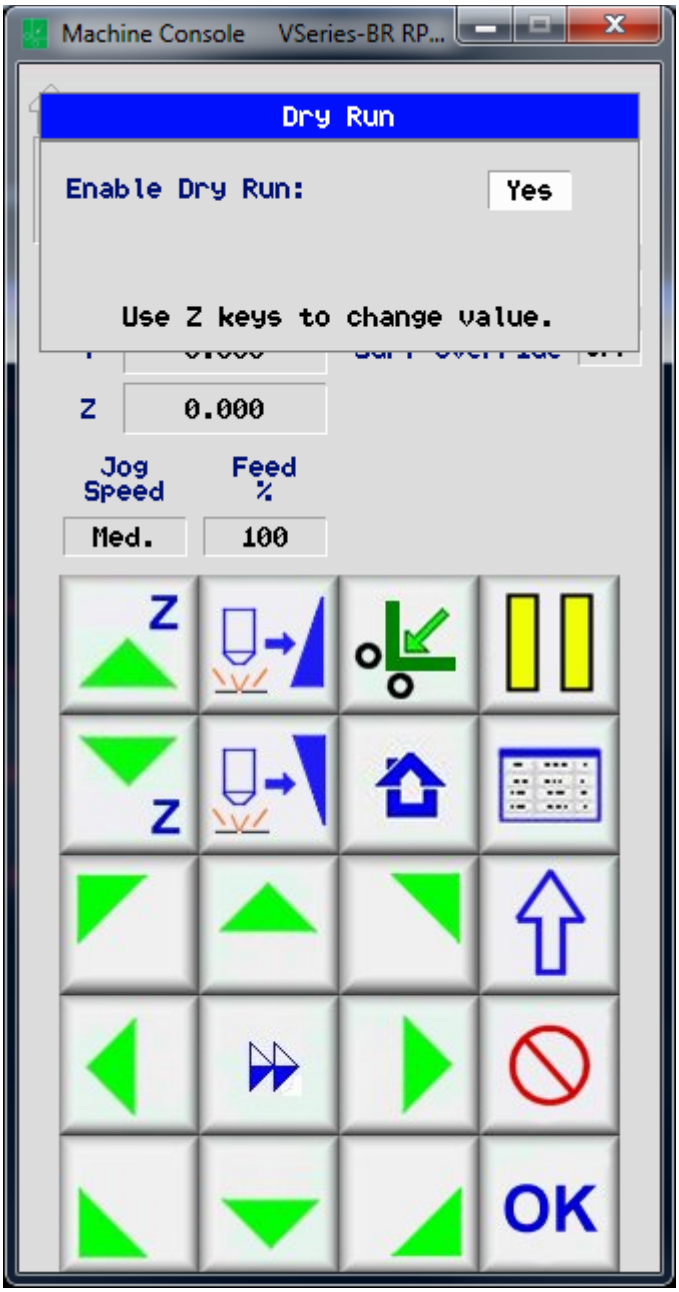
   f. Close

Job Console

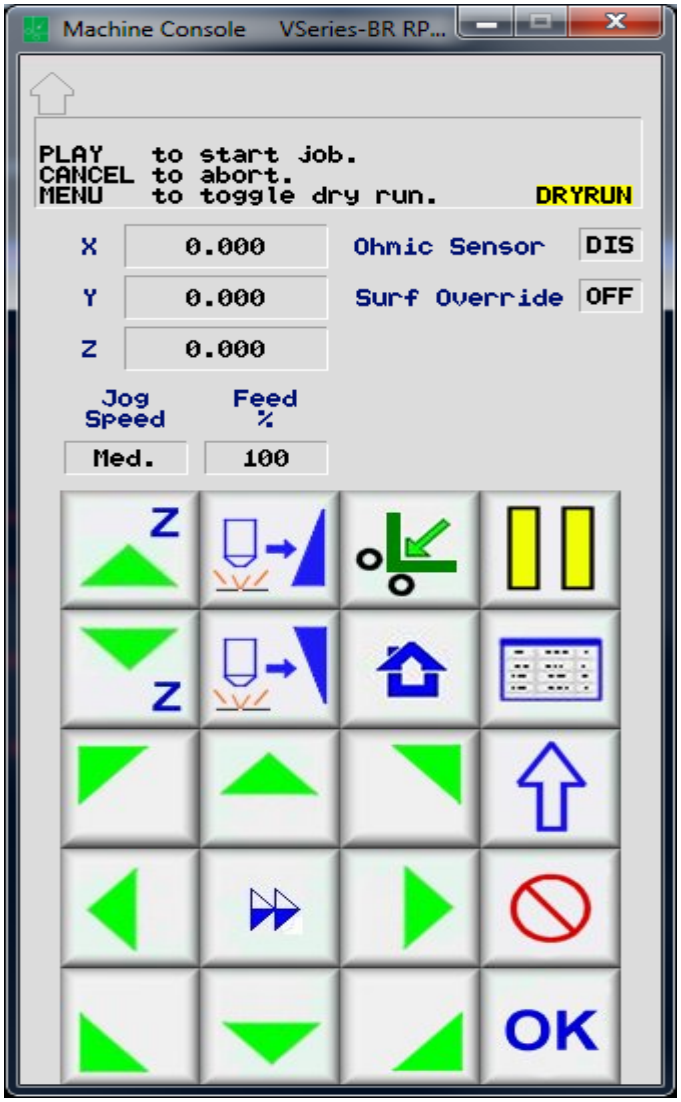
1. Open small yellow folder in top right corner
2. Select the DNC file you want to cut and Open
3. Move the torch to the Sheet Home
4. Click on **Sheet Home**
5. For initial training do not cut; use Dry Run until you can go through Creator without hesitation
    a. From Job Console, select **Execute from Current Sheet**. This can also be accomplished by sending the file from EZ GCode Creator.



i. Once "PLAY to start job." is displayed on the Virtual Keypad press MENU  (Below PAUSE )



i. Use the Z buttons to change DryRun state then select OK.



ii. "**DRYRUN**" will be highlighted Yellow in the bottom right hand corner of the Virtual Keypad Display.

iii. Press START to execute the job in DryRun mode.

iv. Once the file is complete DryRun mode will be disabled.

b. For cutting:

i. Click on Green Gear at top to send the job to the controller

ii. Click Play

iii. After every cut be sure to click **CANCEL**

Re-Start

- Hit to cancel the cut, and to clear the error code
- Move the crosshairs to the restart position
- Ensure the crosshairs are at the position where you had previously stopped your cut
- Click Execution on the menu bar at the top of the page, and select Execute from Current Position , then click Play

Hypertherm Cut Parameters

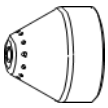
Cut Parameters applicable to all materials and processes

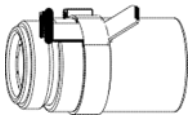
- Max Voltage Gap should always be set to 50
- THC Delay should always be 100 greater (0.1” greater) than Pierce Delay
- If the feedrate is less than or equal to 200 ipm (inches per minute), Use Thin Coef should be set to 0
- If the feedrate is 201 ipm (inches per minute) or greater, Use Thin Coef should be set to 1

Estimated kerf-width compensation - English (inches)

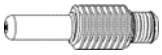
Process	Thickness (inches)										
	22GA	18GA	14GA	10GA	3/16	1/4	3/8	1/2	5/8	3/4	1
	Mild Steel										
105 A Shielded						0.083	0.088	0.089	0.100	0.101	0.133
85 A Shielded				0.068	0.071	0.073	0.078	0.090	0.095	0.100	
65 A Shielded			0.062	0.065	0.068	0.070	0.076	0.088	0.090	0.091	
45 A Shielded	0.035	0.054	0.055	0.061	0.065	0.066					
FineCut	0.028	0.026	0.016	0.023							
Low Speed FineCut	0.026	0.030	0.027	0.023							
105 A Unshielded						0.083	0.097	0.098	0.107	0.111	0.125
85 A Unshielded				0.070	0.073	0.075	0.080	0.085	0.090		
65 A Unshielded			0.062	0.064	0.066	0.068	0.075	0.081			
45 A Unshielded	0.020	0.050	0.051	0.054	0.057	0.059					
Stainless Steel											
105 A Shielded						0.076	0.089	0.091	0.092	0.099	0.113
85 A Shielded				0.065	0.068	0.070	0.080	0.094	0.095	0.096	
65 A Shielded			0.056	0.062	0.068	0.073	0.076	0.090	0.093		
45 A Shielded	0.032	0.055	0.058	0.067	0.069	0.069					
FineCut	0.025	0.019	0.014	0.027							
Low Speed FineCut	0.025	0.023	0.021	0.027							
105 A Unshielded						0.080	0.095	0.101	0.106	0.104	0.122
85 A Unshielded			0.066	0.068	0.070	0.072	0.080	0.090	0.095		
65 A Unshielded			0.061	0.064	0.067	0.070	0.072	0.080			
45 A Unshielded	0.020	0.054	0.052	0.060	0.058	0.058					
Aluminum											
		1/32	1/16	1/8	3/16	1/4	3/8	1/2	5/8	3/4	1
105 A Shielded						0.091	0.092	0.102	0.107	0.111	0.138
85 A Shielded				0.080	0.078	0.075	0.080	0.090	0.095	0.100	
65 A Shielded			0.073	0.074	0.075	0.076	0.083	0.091	0.100		
45 A Shielded		0.059	0.061	0.065		0.060					
105 A Unshielded						0.089	0.098	0.102	0.106	0.117	0.132
85 A Unshielded				0.075	0.075	0.075	0.080	0.082	0.088		
65 A Unshielded			0.070	0.070	0.070	0.070	0.072	0.079			
45 A Unshielded		0.062	0.058	0.057		0.061					

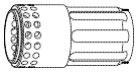
105 A Shielded Consumables

 Shield - 220993

 Ohmic-sensing Retaining Cap - 220953

 Nozzle - 220990

 Electrode - 220842

 Swirl Ring – 220994

105 A Shielded cutting (Mild Steel)

Air flow rate - slpm/scfh	
Hot	217 / 460
Cold	250 / 530

Metric

Material Thickness	Torch-to-Work Distance	Initial Pierce Height		Pierce Delay Time	Best Quality Settings		Production Settings	
					Cut Speed	Voltage	Cut Speed	Voltage
mm	mm	mm	%	seconds	(mm/min)	Volts	(mm/min)	Volts
6	3.2	6.4	200	0.5	4140	144	5090	145
8				0.75	3140	145	3870	145
10					2260	145	2790	145
12					1690	145	2060	148
16				1.0	1060	149	1310	149
20					780	152	940	152
25		Edge Start			550	159	580	158
30					370	162	410	161
32					350	166	370	161
35					290	168	320	165
40					190	173	210	170

English

Material Thickness	Torch-to-Work Distance	Initial Pierce Height		Pierce Delay Time	Best Quality Settings		Production Settings	
					Cut Speed	Voltage	Cut Speed	Voltage
inches	inches	inches	%	seconds	ipm	Volts	ipm	Volts
1/4	0.125	0.25	200	0.5	156	144	192	145
3/8				0.75	94	145	116	145
1/2					62	146	76	148
5/8				1.0	42	149	52	149
3/4					33	151	40	150
7/8				1.25	26	154	30	157
1		Edge Start			21	160	22	158
1-1/8					15	162	17	160
1-1/4					14	166	15	161
1-1/2					9	171	10	168

105 A Shielded cutting (Stainless Steel)

Air flow rate - slpm/scfh	
Hot	217 / 460
Cold	250 / 530

Metric

Material Thickness	Torch-to-Work Distance	Initial Pierce Height		Pierce Delay Time	Best Quality Settings		Production Settings	
					Cut Speed	Voltage	Cut Speed	Voltage
mm	mm	mm	%	seconds	(mm/min)	Volts	(mm/min)	Volts
6	3.2	6.4	200	0.5	4870	139	6000	141
8					3460	141	4210	142
10					2240	144	2670	142
12				0.6	1490	148	1860	144
16				0.75	950	149	1080	149
20		8.0	250	1.25	660	154	810	152
25		Edge Start			440	158	530	156
30					340	164	360	160
32					300	166	320	163

English

Material Thickness	Torch-to-Work Distance	Initial Pierce Height		Pierce Delay Time	Best Quality Settings		Production Settings	
					Cut Speed	Voltage	Cut Speed	Voltage
inches	inches	inches	%	seconds	ipm	Volts	ipm	Volts
1/4	0.125	0.25	200	0.5	185	139	224	141
3/8					94	143	112	142
1/2					55	148	68	145
5/8				0.75	38	149	43	149
3/4		0.31	250	1.25	28	153	34	151
7/8		Edge Start			22	156	27	153
1					17	158	20	156
1-1/8					14	162	16	159
1-1/4					12	166	13	163

105 A Shielded cutting (Aluminum)

Air flow rate - slpm/scfh	
Hot	217 / 460
Cold	250 / 530

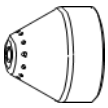
Metric

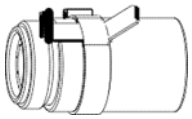
Material Thickness	Torch-to-Work Distance	Initial Pierce Height		Pierce Delay Time	Best Quality Settings		Production Settings	
					Cut Speed	Voltage	Cut Speed	Voltage
mm	mm	mm	%	seconds	(mm/min)	Volts	(mm/min)	Volts
6	3.2	6.4	200	0.5	5980	145	7090	144
8				0.75	4170	149	5020	148
10					2640	152	3280	151
12				1.0	1910	156	2450	154
16					1290	157	1660	155
20				1.25	1020	163	1190	162
25		Edge Start			660	166	790	165
30					430	173	570	171
32					340	175	490	173

English

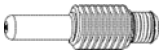
Material Thickness	Torch-to-Work Distance	Initial Pierce Height		Pierce Delay Time	Best Quality Settings		Production Settings	
					Cut Speed	Voltage	Cut Speed	Voltage
inches	inches	inches	%	seconds	ipm	Volts	ipm	Volts
1/4	0.125	0.25	200	0.5	223	146	265	145
3/8				0.75	110	151	136	150
1/2				1.0	71	156	91	154
5/8					51	157	66	155
3/4				1.25	43	162	50	161
7/8		Edge Start			34	164	40	163
1					25	166	30	165
1-1/8					20	171	25	169
1-1/4					15	175	20	173

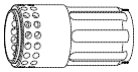
85 A Shielded Consumables

 Shield - 220817

 Ohmic-sensing Retaining Cap - 220953

 Nozzle - 220816

 Electrode - 220842

 Swirl Ring – 220994

85 A Shielded cutting (Mild Steel)

Air flow rate - slpm/scfh	
Hot	194 / 412
Cold	236 / 500

Metric

Material Thickness	Torch-to-Work Distance	Initial Pierce Height		Pierce Delay Time	Best Quality Settings		Production Settings	
					Cut Speed	Voltage	Cut Speed	Voltage
mm	mm	mm	%	seconds	(mm/min)	Volts	(mm/min)	Volts
3	1.5	3.8	250	0.1	6800	122	9200	120
4				0.2	5650	122	7300	122
6				0.5	3600	123	4400	125
8					2500	125	3100	127
10					1680	127	2070	128
12		4.5	300	0.7	1280	130	1600	130
16				1.0	870	134	930	133
20		6.0	400	1.5	570	137	680	136
25		Edge Start			350	142	450	141
30					200	146	300	144

English

Material Thickness	Torch-to-Work Distance	Initial Pierce Height		Pierce Delay Time	Best Quality Settings		Production Settings	
					Cut Speed	Voltage	Cut Speed	Voltage
inches	inches	inches	%	seconds	ipm	Volts	ipm	Volts
10GA	0.06	0.15	250	0.0	250	122	336	121
3/16				0.2	185	123	220	123
1/4				0.5	130	123	160	126
3/8					70	126	86	127
1/2		0.18	300		45	131	56	131
5/8				1.0	35	134	37	133
3/4		0.24	400	1.5	24	136	29	135
7/8		Edge Start			19	139	22	138
1					13	142	17	141
1-1/8					9	145	13	143
1-1/4					7	148	10	146

85 A Shielded cutting (Stainless Steel)

Air flow rate - slpm/scfh	
Hot	194 / 412
Cold	236 / 500

Metric

Material Thickness	Torch-to-Work Distance	Initial Pierce Height		Pierce Delay Time	Best Quality Settings		Production Settings	
					Cut Speed	Voltage	Cut Speed	Voltage
mm	mm	mm	%	seconds	(mm/min)	Volts	(mm/min)	Volts
3	1.5	3.8	250	0.1	7500	122	9200	120
4				0.2	6100	122	7500	120
6				0.5	3700	122	4600	122
8					2450	124	3050	124
10		4.5	300		1550	127	1900	126
12				0.7	1100	131	1400	130
16				1.0	700	135	760	134
20		Edge Start			480	138	570	137
25					300	143	370	141

English

Material Thickness	Torch-to-Work Distance	Initial Pierce Height		Pierce Delay Time	Best Quality Settings		Production Settings	
					Cut Speed	Voltage	Cut Speed	Voltage
inches	inches	inches	%	seconds	ipm	Volts	ipm	Volts
10GA	0.06	0.15	250	0.2	275	122	336	120
3/16					200	122	240	121
1/4				0.5	130	122	164	122
3/8					65	126	80	125
1/2		0.18	300		36	132	48	131
5/8				1.0	28	135	30	134
3/4		Edge Start			20	137	24	136
7/8					16	140	19	139
1					11	143	14	141

85 A Shielded cutting (Aluminum)

Air flow rate - slpm/scfh	
Hot	194 / 412
Cold	236 / 500

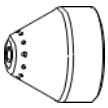
Metric

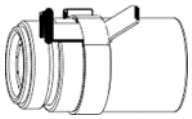
Material Thickness	Torch-to-Work Distance	Initial Pierce Height		Pierce Delay Time	Best Quality Settings		Production Settings	
					Cut Speed	Voltage	Cut Speed	Voltage
mm	mm	mm	%	seconds	(mm/min)	Volts	(mm/min)	Volts
3	1.5	3.8	250	0.1	8000	122	9400	121
4				0.2	6500	123	8000	123
6				0.5	3800	126	4900	126
8					2650	130	3470	129
10		4.5	300		1920	132	2500	131
12				0.7	1450	134	1930	133
16				1.0	950	139	1200	137
20		Edge Start			600	143	880	141
25					380	146	540	144

English

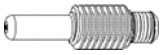
Material Thickness	Torch-to-Work Distance	Initial Pierce Height		Pierce Delay Time	Best Quality Settings		Production Settings	
					Cut Speed	Voltage	Cut Speed	Voltage
inches	inches	inches	%	seconds	ipm	Volts	ipm	Volts
1/8	0.06	0.15	250	0.2	300	122	360	121
1/4				0.5	130	127	172	127
3/8					80	132	104	131
1/2		0.18	300		50	135	68	133
5/8				1.0	38	139	48	137
3/4		Edge Start			25	142	37	140
7/8					20	144	29	142
1					14	146	20	144

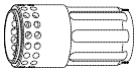
65 A Shielded Consumables

 Shield - 220817

 Ohmic-sensing Retaining Cap - 220953

 Nozzle - 220819

 Electrode - 220842

 Swirl Ring – 220994

65 A Shielded cutting (Mild Steel)

Air flow rate - slpm/scfh	
Hot	175 / 370
Cold	209 / 443

Metric

Material Thickness	Torch-to-Work Distance	Initial Pierce Height		Pierce Delay Time	Best Quality Settings		Production Settings	
					Cut Speed	Voltage	Cut Speed	Voltage
mm	mm	mm	%	seconds	(mm/min)	Volts	(mm/min)	Volts
2	1.5	3.8	250	0.1	6050	124	7000	121
3				0.2	5200	125	6100	123
4				0.5	4250	125	5100	124
6					2550	127	3240	127
8					1700	129	2230	128
10		4.5	300	0.7	1100	131	1500	129
12				1.2	850	134	1140	131
16		6.0	400	2.0	560	138	650	136
20		Edge Start			350	142	450	142
25					210	145	270	145

English

Material Thickness	Torch-to-Work Distance	Initial Pierce Height		Pierce Delay Time	Best Quality Settings		Production Settings	
					Cut Speed	Voltage	Cut Speed	Voltage
inches	inches	inches	%	seconds	ipm	Volts	ipm	Volts
16GA	0.06	0.15	250	0.1	260	123	294	121
10GA					190	125	224	123
3/16				0.2	140	126	168	125
1/4				0.5	90	127	116	127
3/8				0.7	45	130	62	129
1/2		0.18	300	1.2	30	135	40	132
5/8		0.24	400	2.0	23	138	26	136
3/4		Edge Start			15	141	19	141
7/8					12	143	14	143
1					8	145	10	145

65 A Shielded cutting (Stainless Steel)

Air flow rate - slpm/scfh	
Hot	175 / 370
Cold	209 / 443

Metric

Material Thickness	Torch-to-Work Distance	Initial Pierce Height		Pierce Delay Time	Best Quality Settings		Production Settings	
					Cut Speed	Voltage	Cut Speed	Voltage
mm	mm	mm	%	seconds	(mm/min)	Volts	(mm/min)	Volts
2	1.5	3.8	250	0.1	8100	125	10000	121
3				0.2	6700	125	8260	123
4				0.5	5200	125	6150	124
6					2450	126	2850	126
8				0.7	1500	129	1860	129
10		4.5	300		960	132	1250	132
12				1.2	750	135	920	134
16		Edge Start			500	139	500	139
20					300	143	370	143

English

Material Thickness	Torch-to-Work Distance	Initial Pierce Height		Pierce Delay Time	Best Quality Settings		Production Settings	
					Cut Speed	Voltage	Cut Speed	Voltage
inches	inches	inches	%	seconds	ipm	Volts	ipm	Volts
16GA	0.06	0.15	250	0.1	345	124	426	121
10GA					240	125	296	123
3/16				0.2	155	126	168	125
1/4				0.5	80	126	96	126
3/8				0.7	40	131	52	131
1/2		0.18	300	1.2	26	136	32	135
5/8		Edge Start			20	139	20	139
3/4					14	142	15	142

65 A Shielded cutting (Aluminum)

Air flow rate - slpm/scfh	
Hot	175 / 370
Cold	209 / 443

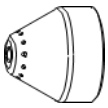
Metric

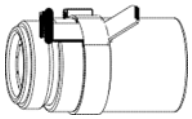
Material Thickness	Torch-to-Work Distance	Initial Pierce Height		Pierce Delay Time	Best Quality Settings		Production Settings	
					Cut Speed	Voltage	Cut Speed	Voltage
mm	mm	mm	%	seconds	(mm/min)	Volts	(mm/min)	Volts
2	1.5	3.8	250	0.1	8800	121	10300	122
3				0.2	7400	124	8800	124
4				0.5	6000	126	7350	125
6					3200	130	4400	128
8				0.7	1950	133	2750	130
10		4.5	300		1200	136	1650	132
12				1.2	1000	138	1330	136
16		Edge Start			650	143	800	141
20					380	147	560	145

English

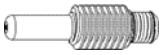
Material Thickness	Torch-to-Work Distance	Initial Pierce Height		Pierce Delay Time	Best Quality Settings		Production Settings	
					Cut Speed	Voltage	Cut Speed	Voltage
inches	inches	inches	%	seconds	ipm	Volts	ipm	Volts
1/16	0.06	0.15	250	0.1	365	121	428	121
1/8					280	124	336	124
1/4				0.5	105	131	152	128
3/8				0.7	50	135	68	131
1/2		0.18	300	1.2	35	139	48	138
5/8		Edge Start			26	143	32	141
3/4					16	146	24	144

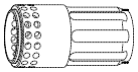
45 A Shielded Consumables

 Shield - 220817

 Ohmic-sensing Retaining Cap - 220953

 Nozzle - 220941

 Electrode - 220842

 Swirl Ring – 220994

45 A Shielded cutting (Mild Steel)

Air flow rate - slpm/scfh	
Hot	177 / 376
Cold	201 / 427

Metric

Material Thickness	Torch-to-Work Distance	Initial Pierce Height		Pierce Delay Time	Best Quality Settings		Production Settings	
					Cut Speed	Voltage	Cut Speed	Voltage
mm	mm	mm	%	seconds	(mm/min)	Volts	(mm/min)	Volts
0.5	1.5	3.8	250	0.0	9000	128	12500	126
1					9000	128	10800	128
1.5				0.1	9000	130	10200	129
2				0.3	6600	130	7800	129
3				0.4	3850	133	4900	131
4					2200	134	3560	131
6				0.5	1350	137	2050	132

English

Material Thickness	Torch-to-Work Distance	Initial Pierce Height		Pierce Delay Time	Best Quality Settings		Production Settings	
					Cut Speed	Voltage	Cut Speed	Voltage
inches	inches	inches	%	seconds	ipm	Volts	ipm	Volts
26GA	0.02	0.08	400	0.0	350	128	500	128
22GA					350	128	450	128
18GA				0.1	350	129	400	128
16GA					350	130	400	129
14GA	0.06	0.15	250	0.2	270	130	320	129
12GA				0.4	190	133	216	131
10GA					100	134	164	131
3/16				0.5	70	135	108	132
1/4				0.6	48	137	73	132

45 A Shielded cutting (Stainless Steel)

Air flow rate - slpm/scfh	
Hot	177 / 376
Cold	201 / 427

Metric

Material Thickness	Torch-to-Work Distance	Initial Pierce Height		Pierce Delay Time	Best Quality Settings		Production Settings	
					Cut Speed	Voltage	Cut Speed	Voltage
mm	mm	mm	%	seconds	(mm/min)	Volts	(mm/min)	Volts
0.5	1.5	3.8	250	0.0	9000	130	12500	129
1					9000	130	10800	130
1.5				0.1	9000	130	10200	130
2				0.3	6000	132	8660	131
3				0.4	3100	132	4400	132
4					2000	134	2600	134
6				0.5	900	140	1020	139

English

Material Thickness	Torch-to-Work Distance	Initial Pierce Height		Pierce Delay Time	Best Quality Settings		Production Settings	
					Cut Speed	Voltage	Cut Speed	Voltage
inches	inches	inches	%	seconds	ipm	Volts	ipm	Volts
26GA	0.02	0.08	400	0.0	350	130	500	129
22GA					350	130	450	129
18GA				0.1	350	130	400	130
16GA					350	130	400	130
14GA	0.06	0.15	250	0.2	250	132	360	131
12GA				0.4	140	132	206	131
10GA					100	133	134	134
3/16				0.5	52	135	58	135
1/4				0.6	30	141	35	140

45 A Shielded cutting (Aluminum)

Air flow rate - slpm/scfh	
Hot	177 / 376
Cold	201 / 427

Metric

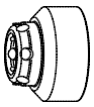
Material Thickness	Torch-to-Work Distance	Initial Pierce Height		Pierce Delay Time	Best Quality Settings		Production Settings	
					Cut Speed	Voltage	Cut Speed	Voltage
mm	mm	mm	%	seconds	(mm/min)	Volts	(mm/min)	Volts
1	1.5	3.8	250	0.0	8250	136	11000	136
2				0.1	6600	136	9200	135
3				0.2	3100	139	6250	134
4				0.4	2200	141	4850	135
6				0.5	1500	142	2800	137

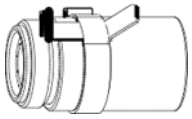
English

Material Thickness	Torch-to-Work Distance	Initial Pierce Height		Pierce Delay Time	Best Quality Settings		Production Settings	
					Cut Speed	Voltage	Cut Speed	Voltage
inches	inches	inches	%	seconds	ipm	Volts	ipm	Volts
1/32	0.06	0.15	250	0.0	325	136	450	136
1/16				0.1	325	136	400	136
3/32				0.2	200	136	328	134
1/8				0.4	100	140	224	134
1/4				0.5	54	142	96	137

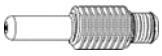
FineCut® Shielded Consumables

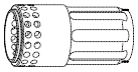
Note: The cut charts in this section apply to both shielded and unshielded consumables.

 Shield - 220948

 Ohmic-sensing Retaining Cap - 220953

 Nozzle - 220930

 Electrode - 220842

 Swirl Ring – 220994

FineCut (Mild Steel)

Air flow rate - slpm/scfh	
Hot	181 / 384
Cold	191 / 404

Metric

Material Thickness	Current	Torch-to-Work Distance	Initial Pierce Height		Pierce Delay Time	Recommended	
						Cut Speed	Voltage
mm	A	mm	mm	%	seconds	(mm/min)	Volts
0.5	40	1.5	2.25	150	0.0	8250	78
0.6						8250	78
0.8					0.1	8250	78
1	45				0.2	8250	78
1.5					0.4	6400	78
2						4800	78
3					0.5	2750	78
4					0.6	1900	78

English

Material Thickness	Current	Torch-to-Work Distance	Initial Pierce Height		Pierce Delay Time	Recommended	
						Cut Speed	Voltage
	A	inches	inches	%	seconds	ipm	Volts
26GA	40	0.06	0.09	150	0.0	325	78
24GA						325	78
22GA					0.1	325	78
20GA						325	78
18GA	45				0.2	325	78
16GA					0.4	250	78
14GA						200	78
12GA					0.5	120	78
10GA						95	78

FineCut (Stainless Steel)

Air flow rate - slpm/scfh	
Hot	181 / 384
Cold	191 / 404

Metric

Material Thickness	Current	Torch-to-Work Distance	Initial Pierce Height		Pierce Delay Time	Recommended	
						Cut Speed	Voltage
mm	A	mm	mm	%	seconds	(mm/min)	Volts
0.5	40	0.5	2.0	400	0.0	8250	68
0.6						8250	68
0.8					0.1	8250	68
1	45				0.15	8250	68
1.5					0.4	6150	70
2						4800	71
3					0.5	2550	80
4					0.6	1050	80

English

Material Thickness	Current	Torch-to-Work Distance	Initial Pierce Height		Pierce Delay Time	Recommended	
						Cut Speed	Voltage
	A	inches	inches	%	seconds	ipm	Volts
26GA	40	0.02	0.08	400	0.0	325	68
24GA						325	68
22GA					0.1	325	68
20GA						325	68
18GA	45				0.2	325	68
16GA					0.4	240	70
14GA						200	70
12GA					0.5	120	80
10GA					0.6	75	80

Low Speed FineCut (Mild Steel)

Air flow rate - slpm/scfh	
Hot	181 / 384
Cold	191 / 404

Metric

Material Thickness	Current	Torch-to-Work Distance	Initial Pierce Height		Pierce Delay Time	Recommended	
						Cut Speed	Voltage
mm	A	mm	mm	%	seconds	(mm/min)	Volts
0.5	30	1.5	2.25	150	0.0	3800	69
0.6						3800	68
0.8					0.1	3800	70
1 *	40				0.2	3800	72
1.5 *					0.4	3800	75
2	45					3700	76
3					0.5	2750	78
4						1900	78

English

Material Thickness	Current	Torch-to-Work Distance	Initial Pierce Height		Pierce Delay Time	Recommended	
						Cut Speed	Voltage
	A	inches	inches	%	seconds	ipm	Volts
26GA	30	0.06	0.09	150	0.0	150	70
24GA						150	68
22GA					0.1	150	70
20GA						150	71
18GA	40				0.2	150	73
16GA *					0.4	150	75
14GA *	45					150	76
12GA					0.5	120	78
10GA						95	78

*Not a dross-free cut.

Low Speed FineCut (Stainless Steel)

Air flow rate - slpm/scfh	
Hot	181 / 384
Cold	191 / 404

Metric

Material Thickness	Current	Torch-to-Work Distance	Initial Pierce Height		Pierce Delay Time	Recommended	
						Cut Speed	Voltage
mm	A	mm	mm	%	seconds	(mm/min)	Volts
0.5	30	0.5	2.0	400	0.0	3800	69
0.6						3800	69
0.8					0.1	3800	69
1	40				0.15	3800	69
1.5					0.4	2900	69
2						2750	69
3	45				0.5	2550	80
4					0.6	1050	80

English

Material Thickness	Current	Torch-to-Work Distance	Initial Pierce Height		Pierce Delay Time	Recommended	
						Cut Speed	Voltage
	A	in	in	%	seconds	ipm	Volts
26GA	30	0.02	0.08	400	0.0	150	69
24GA						150	69
22GA					0.1	150	69
20GA						150	69
18GA	40				0.2	145	69
16GA					0.4	115	69
14GA						110	69
12GA	45				0.5	120	80
10GA					0.6	75	80

Thermal Dynamics Cut Parameters

The consumables shown do not include the Ohmic clip. You will need to order the Ohmic clip (part number 9-8259) along with the other consumables.

Mild Steel – 120A

Shield Cap	Maximum Life Shield Cup		Tip	Starter Cartridge		Electrode	
9-8256	9-8237		9-8233	9-8213		9-8232	
Material Thickness		Gas Pressure (Air)	Arc Voltage	Torch Working Height	Travel Speed	Initial Piercing Height	Pierce Delay	Kerf Width @ Rec. Speed
(GA) (in)	inch	PSI (torch lead length)	Volts	(in)	(ipm)	(in)	(sec)	(in)
1/4	0.250	80 (25') 80 (50')	139	0.125	160	0.20	0.20	0.11
3/8	0.375		140	0.125	85	0.20	0.20	0.11
1/2	0.500		142	0.125	75	0.20	0.50	0.10
5/8	0.625		144	0.125	45	0.20	0.70	0.11
3/4	**0.750**		**150**	**0.125**	**30**	**0.25**	**1.50**	**0.12**
7/8	***0.875***		***158***	***0.175***	***25***	***Edge Start***		***0.13***
1	***1.000***		***160***	***0.175***	***22***	***Edge Start***		***0.14***
1-1/4	***1.250***		***165***	***0.175***	***15***	***Edge Start***		***0.17***
1-1/2	***1.500***		***171***	***0.175***	***8***	***Edge Start***		***0.15***
Material Thickness		Gas Pressure (Air)	Arc Voltage	Torch Working Height	Travel Speed	Initial Piercing Height	Pierce Delay	Kerf Width @ Rec. Speed
(mm)		Bar (torch lead length)	Volts	(mm)	(mm/min)	(mm)	(sec)	(mm)
6		5.5 (7.6m) 5.5 (15.2m)	139	4.8	4270	5.08	0.20	2.8
8			140	4.8	3070	5.1	0.2	2.8
10			140	6.4	2120	5.08	0.30	2.8
12			142	6.4	1960	5.08	0.50	2.8
15			143	4.8	1355	5.08	0.70	2.8
20			**152**	**4.8**	**725**	**6.4**	**1.6**	**3.1**
25			***160***	***4.8***	***570***	***Edge Start***		***3.6***
30			***164***	***4.8***	***430***	***Edge Start***		***4.0***
35			***168***	***4.8***	***290***	***Edge Start***		***4.3***
40			***173***	***4.45***	***150***	***Edge Start***		***4.4***

Stainless Steel – 120A

Shield Cap	Maximum Life Shield Cup	Tip	Starter Cartridge	Electrode
9-8256	9-8237	9-8233	9-8213	9-8232

Material Thickness			Gas Pressure (Air)	Arc Voltage	Torch Working Height	Travel Speed	Initial Piercing Height	Pierce Delay	Kerf Width @ Rec. Speed
(GA)	(in)	inch	PSI (torch lead length)	Volts	(in)	(ipm)	(in)	(sec)	(in)
	1/4	0.250	80 (25') 80 (50')	140	0.13	180	0.20	0.30	0.11
	3/8	0.375		140	0.13	100	0.20	0.40	0.12
	1/2	0.500		142	0.15	65	0.25	0.80	0.12
	5/8	**0.625**		**152**	**0.15**	**40**	**0.25**	**1.00**	**0.12**
	3/4	***0.750***		***150***	***0.15***	***26***	***Edge Start***		***0.13***
	1	***1.000***		***155***	***0.15***	***16***	***Edge Start***		***0.13***
	1-1/4	***1.250***		***165***	***0.15***	***8***	***Edge Start***		***0.13***

Material Thickness	Gas Pressure (Air)	Arc Voltage	Torch Working Height	Travel Speed	Initial Piercing Height	Pierce Delay	Kerf Width @ Rec. Speed
(mm)	Bar (torch lead length)	Volts	(mm)	(mm/min)	(mm)	(sec)	(mm)
6	5.5 (7.6m) 5.5 (15.2m)	140	4.8	4800	5.1	0.3	2.8
8		140	4.8	3520	5.1	0.4	2.7
10		140	4.8	2410	5.1	0.6	3.0
12		142	4.8	1850	6.4	0.8	3.1
15		**149**	**6.4**	**1190**	**6.4**	**1.0**	**3.1**
20		***151***	***6.4***	***620***	***Edge Start***		***3.3***
25		***155***	***6.4***	***420***	***Edge Start***		***3.3***
30		***162***	***6.4***	***260***	***Edge Start***		***3.3***

Aluminum – 120A

Shield Cap	Maximum Life Shield Cup	Tip	Starter Cartridge	Electrode
9-8256	9-8237	9-8233	9-8213	9-8232

Material Thickness			Gas Pressure (Air)	Arc Voltage	Torch Working Height	Travel Speed	Initial Piercing Height	Pierce Delay	Kerf Width @ Rec. Speed
(GA)	(in)	inch	PSI (torch lead length)	Volts	(in)	(ipm)	(in)	(sec)	(in)
	1/4	0.250	80 (25') 80 (50')	140	0.13	180	0.20	0.20	0.10
	3/8	0.375		142	0.13	110	0.20	0.30	0.11
	1/2	0.500		148	0.13	75	0.20	0.50	0.11
	5/8	**0.625**		**156**	**0.15**	**45**	**0.25**	**0.80**	**0.11**
	3/4	***0.750***		***158***	***0.15***	***35***	***Edge Start***		***0.11***
	1	***1.000***		***164***	***0.15***	***23***	***Edge Start***		***0.12***

Material Thickness	Gas Pressure (Air)	Arc Voltage	Torch Working Height	Travel Speed	Initial Piercing Height	Pierce Delay	Kerf Width @ Rec. Speed
(mm)	Bar (torch lead length)	Volts	(mm)	(mm/min)	(mm)	(sec)	(mm)
6	5.5 (7.6m) 5.5 (15.2m)	140	4.8	4770	5.1	0.2	2.6
8		141	4.8	3650	5.1	0.3	2.6
10		143	4.8	2660	5.1	0.4	2.7
12		147	4.8	2100	5.1	0.5	2.8
15		**154**	**4.8**	**1355**	**6.4**	**0.8**	**2.8**
20		***159***	***4.8***	***845***	***Edge Start***		***2.9***
25		***164***	***4.8***	***605***	***Edge Start***		***3.0***

Mild Steel – 100A

Deflector	Standard Shield Cup Maximum Life Shield Cup	Tip	Starter Cartridge	Electrode
9-8243	9-8237	9-8212	9-8213	9-8232

Material Thickness			Gas Pressure (Air)	Arc Voltage	Torch Working Height	Travel Speed	Initial Piercing Height	Pierce Delay	Kerf Width @ Rec. Speed
(GA)	(in)	inch	PSI (torch lead length)	Volts	(in)	(ipm)	(in)	(sec)	(in)
	1/4	0.250	75 (25') 75 (50')	110	0.18	85	0.20	0.10	0.09
	3/8	0.375		112	0.18	75	0.20	0.20	0.09
	1/2	0.500		115	0.18	45	0.20	0.40	0.10
	5/8	0.625		118	0.18	30	0.20	0.60	0.11
	3/4	**0.750**		**120**	**0.18**	**20**	**0.20**	**1.20**	**0.12**
	1	***1.000***		***123***	***0.18***	***15***	***Edge Start***		***0.12***
	1-1/4	***1.250***		***128***	***0.18***	***8***	***Edge Start***		***0.13***

Material Thickness	Gas Pressure (Air)	Arc Voltage	Torch Working Height	Travel Speed	Initial Piercing Height	Pierce Delay	Kerf Width @ Rec. Speed
(mm)	Bar (torch lead length)	Volts	(mm)	(mm/min)	(mm)	(sec)	(mm)
6	5.2 (7.6m) 5.2 (15.2m)	110	4.6	2200	5.1	0.10	2.3
8		111	4.6	2030	5.1	0.10	2.3
10		112	4.6	1790	5.1	0.20	2.3
12		114	4.6	1310	5.1	0.40	2.5
15		117	4.6	870	5.1	0.60	2.7
20		**120**	**4.6**	**490**	**5.0**	**1.20**	**3.0**
25		***123***	***4.6***	***390***	***Edge Start***		***3.0***
30		***127***	***4.6***	***250***	***Edge Start***		***3.2***

Stainless Steel – 100A

Deflector	Standard Shield Cup Maximum Life Shield Cup	Tip	Starter Cartridge	Electrode
9-8243	9-8237	9-8212	9-8213	9-8232

Material Thickness			Gas Pressure (Air)	Arc Voltage	Torch Working Height	Travel Speed	Initial Piercing Height	Pierce Delay	Kerf Width @ Rec. Speed
(GA)	(in)	inch	PSI (torch lead length)	Volts	(in)	(ipm)	(in)	(sec)	(in)
	1/4	0.250	75 (25') 75 (50')	102	0.16	100	0.18	0.00	0.09
	3/8	0.375		106	0.16	65	0.18	0.10	0.10
	1/2	0.500		**109**	0.16	45	0.18	0.30	0.10
	5/8	***0.625***		***123***	***0.19***	***20***	***0.23***	***2.00***	***0.11***
	3/4	***0.750***		***128***	***0.19***	***15***	***Edge Start***		***0.12***
	1	***1.000***		135	***0.19***	***10***	***Edge Start***		***0.13***

Material Thickness	Gas Pressure (Air)	Arc Voltage	Torch Working Height	Travel Speed	Initial Piercing Height	Pierce Delay	Kerf Width @ Rec. Speed
(mm)	Bar (torch lead length)	Volts	(mm)	(mm/min)	(mm)	(sec)	(mm)
6	5.2 (7.6m) 5.2 (15.2m)	102	4.1	2630	4.6	0.00	2.3
8		104	4.1	2080	4.6	0.10	2.4
10		106	4.1	1575	4.6	0.20	2.4
12		108	4.1	1255	4.6	0.30	2.4
15		**119**	**4.6**	**685**	**5.7**	**2.00**	**2.7**
20		***129***	***4.8***	***360***	***Edge Start***		***3.1***
25		***135***	***4.8***	***260***	***Edge Start***		***3.2***

Aluminum – 100A

Deflector	Standard Shield Cup Maximum Life Shield Cup	Tip	Starter Cartridge	Electrode
9-8243	9-8237	9-8212	9-8213	9-8232

Material Thickness			Gas Pressure (Air)	Arc Voltage	Torch Working Height	Travel Speed	Initial Piercing Height	Pierce Delay	Kerf Width @ Rec. Speed
(GA)	(in)	inch	PSI (torch lead length)	Volts	(in)	(ipm)	(in)	(sec)	(in)
	1/4	0.250	75 (25') 75 (50')	110	0.19	100	0.20	0.00	0.09
	3/8	0.375		124	0.19	65	0.20	0.20	0.10
	1/2	0.500		128	0.19	45	0.20	0.30	0.11
	5/8	0.625		132	0.19	35	0.20	0.50	0.11
	3/4	**0.750**		**135**	**0.19**	**20**	**0.20**	**2.00**	**0.13**
	1	***1.000***		***140***	***0.19***	***10***	***Edge Start***		***0.13***

Material Thickness	Gas Pressure (Air)	Arc Voltage	Torch Working Height	Travel Speed	Initial Piercing Height	Pierce Delay	Kerf Width @ Rec. Speed
(mm)	Bar (torch lead length)	Volts	(mm)	(mm/min)	(mm)	(sec)	(mm)
6	5.2 (7.6m) 5.2 (15.2m)	109	4.8	2630	5.1	0.00	2.3
8		117	4.8	2080	5.1	0.10	2.5
10		125	4.8	1575	5.1	0.20	2.7
12		127	4.8	1255	5.1	0.30	2.7
15		131	4.8	960	5.1	0.50	2.8
20		**136**	**4.8**	**470**	**6.0**	**2.00**	**3.3**
25		***140***	***4.8***	***270***	***Edge Start***		***3.4***

Mild Steel – 80A

Deflector		Standard Shield Cup Maximum Life Shield Cup		Tip	Starter Cartridge		Electrode	
9-8243		9-8237		9-8211	9-8213		9-8232	
Material Thickness			Gas Pressure (Air)	Arc Voltage	Torch Working Height	Travel Speed	Initial Piercing Height	Pierce Delay	Kerf Width @ Rec. Speed
(GA)	(in)	inch	PSI (torch lead length)	Volts	(in)	(ipm)	(in)	(sec)	(in)
16		0.060	85 (25') 90 (50')	110	0.19	320	0.20	0.00	0.06
11		0.120		113	0.19	230	0.20	0.10	0.07
10		0.135		110	0.19	180	0.20	0.20	0.07
	3/16	0.188		110	0.19	136	0.20	0.30	0.07
	1/4	0.250		115	0.19	100	0.20	0.40	0.09
	3/8	0.375		125	0.19	42	0.20	0.50	0.09
	1/2	0.500		123	0.19	40	0.20	0.60	0.09
	5/8	**0.625**		**133**	**0.19**	**18**	**0.20**	**0.75**	**0.10**
	3/4	***0.750***		***140***	***0.25***	***18***	***Edge Start***		***0.11***
	7/8	***0.875***		***150***	***0.25***	***10***	***Edge Start***		***0.11***
	1	***1.000***		***152***	***0.25***	***8***	***Edge Start***		***0.13***

Material Thickness	Gas Pressure (Air)	Arc Voltage	Torch Working Height	Travel Speed	Initial Piercing Height	Pierce Delay	Kerf Width @ Rec. Speed
(mm)	Bar (torch lead length)	Volts	(mm)	(mm/min)	(mm)	(sec)	(mm)
1	5.9 (7.6m) 6.2 (15.2m)	109	4.8	8915	5.1	0.00	1.5
2		111	4.8	7415	5.1	0.10	1.7
3		113	4.8	5915	5.1	0.10	1.8
4		110	4.8	4095	5.1	0.30	1.7
5		111	4.8	3325	5.1	0.30	1.8
6		114	4.8	2745	5.1	0.40	2.2
8		120	4.8	1775	5.1	0.50	2.3
10		125	4.8	1060	5.1	0.50	2.3
12		123	4.8	1025	5.1	0.60	2.3
15		**130**	**4.8**	**610**	**5.1**	**0.75**	**2.5**
20		***143***	***6.4***	***395***	***Edge Start***		***2.7***
25		***152***	***6.4***	***210***	***Edge Start***		***3.2***

Stainless Steel – 80A

Deflector		Standard Shield Cup Maximum Life Shield Cup		Tip	Starter Cartridge		Electrode	
9-8243		9-8237		9-8211	9-8213		9-8232	
Material Thickness			Gas Pressure (Air)	Arc Voltage	Torch Working Height	Travel Speed	Initial Piercing Height	Pierce Delay	Kerf Width @ Rec. Speed
(GA)	(in)	inch	PSI (torch lead length)	Volts	(in)	(ipm)	(in)	(sec)	(in)
16		0.063	85 (25') 90 (50')	110	0.19	340	0.25	0.00	0.06
11		0.125		115	.0.19	300	0.25	0.10	0.06
10		0.141		115	0.19	280	0.25	0.10	0.06
	3/16	0.188		115	0.19	140	0.25	0.20	0.07
	1/4	0.250		118	0.19	100	0.25	0.30	0.08
	3/8	0.375		119	0.19	45	0.25	0.40	0.08
	1/2	**0.500**		**124**	**0.19**	**26**	**0.25**	**0.80**	**0.10**
	5/8	***0.625***		***133***	***0.19***	***16***	***Edge Start***		***0.10***
	3/4	***0.750***		***136***	***0.19***	***10***	***Edge Start***		***0.11***

Material Thickness	Gas Pressure (Air)	Arc Voltage	Torch Working Height	Travel Speed	Initial Piercing Height	Pierce Delay	Kerf Width @ Rec. Speed
(mm)	Bar (torch lead length)	Volts	(mm)	(mm/min)	(mm)	(sec)	(mm)
1	5.9 (7.6m) 6.2 (15.2m)	108	4.8	9020	6.4	0.00	1.5
2		111	4.8	8380	6.4	0.00	1.5
3		114	4.8	7730	6.4	0.10	1.5
4		115	4.8	5865	6.4	0.20	1.6
5		115	4.8	3410	6.4	0.20	1.8
6		117	4.8	2765	6.4	0.30	1.9
8		119	4.8	1815	6.4	0.40	2.0
10		120	4.8	1070	6.4	0.60	2.1
12		**123**	**4.8**	**765**	**6.4**	**0.80**	**2.3**
15		***131***	***4.8***	***475***	***Edge Start***		***2.5***
20		***137***	***4.8***	***205***	***Edge Start***		***3.0***

Aluminum – 80A

Deflector	Standard Shield Cup Maximum Life Shield Cup	Tip	Starter Cartridge	Electrode
9-8243	9-8237	9-8211	9-8213	9-8232

Material Thickness			Gas Pressure (Air)	Arc Voltage	Torch Working Height	Travel Speed	Initial Piercing Height	Pierce Delay	Kerf Width @ Rec. Speed
(GA)	(in)	inch	PSI (torch lead length)	Volts	(in)	(ipm)	(in)	(sec)	(in)
16		0.064	85 (25') 90 (50')	116	0.25	350	0.25	0.00	0.10
11		0.120		120	0.25	280	0.25	0.10	0.10
	3/16	0.188		124	0.25	180	0.25	0.20	0.10
	1/4	0.250		130	0.25	110	0.25	0.30	0.09
	3/8	0.375		136	0.25	55	0.25	0.40	0.11
	1/2	0.500		139	0.25	38	0.25	0.60	0.11
	5/8	**0.625**		**136**	**0.19**	**26**	**0.25**	**0.75**	**0.10**
	3/4	***0.750***		***150***	***0.19***	***14***	***Edge Start***		***0.12***
	7/8	***0.875***		***153***	***0.19***	***10***	***Edge Start***		***0.11***

Material Thickness	Gas Pressure (Air)	Arc Voltage	Torch Working Height	Travel Speed	Initial Piercing Height	Pierce Delay	Kerf Width @ Rec. Speed
(mm)	Bar (torch lead length)	Volts	(mm)	(mm/min)	(mm)	(sec)	(mm)
1	5.9 (7.6m) 6.2 (15.2m)	114	6.4	8890	6.4	0.00	2.4
2		117	6.4	8420	6.4	0.00	2.5
3		120	6.4	7170	6.4	0.10	2.5
4		122	6.4	5710	6.4	0.20	2.5
5		125	6.4	4315	6.4	0.20	2.5
6		129	6.4	3190	6.4	0.30	2.4
8		133	6.4	2070	6.4	0.40	2.5
10		136	6.4	1330	6.4	0.50	2.7
12		138	6.4	1060	6.4	0.50	2.9
15		**137**	**4.8**	**745**	**6.4**	**0.75**	**2.5**
20		***151***	***4.8***	***325***	***Edge Start***		***3.0***

Mild Steel – 60A

Deflector		Standard Shield Cup Maximum Life Shield Cup		Tip	Starter Cartridge		Electrode	
9-8243		9-8237		9-8210	9-8213		9-8232	
Material Thickness			Gas Pressure (Air)	Arc Voltage	Torch Working Height	Travel Speed	Initial Piercing Height	Pierce Delay	Kerf Width @ Rec. Speed
(GA)	(in)	inch	PSI (torch lead length)	Volts	(in)	(ipm)	(in)	(sec)	(in)
16		0.060	85 (25') 90 (50')	118	0.19	290	0.19	0.00	0.08
14		0.075		120	0.19	285	0.19	0.10	0.08
11		0.120		118	0.19	180	0.19	0.10	0.08
10		0.135		119	0.19	176	0.19	0.10	0.07
	3/16	0.188		121	0.19	100	0.19	0.20	0.08
	1/4	0.250		122	0.19	80	0.19	0.30	0.08
	3/8	0.375		124	0.19	50	0.19	0.50	0.09
	1/2	**0.500**		**132**	**0.19**	**26**	**0.19**	**0.75**	**0.10**
	5/8	***0.625***		***135***	***0.19***	***19***	***Edge Start***		***0.10***
	3/4	***0.750***		***136***	***0.19***	***14***	***Edge Start***		***0.08***
	1	***1.000***		***150***	***0.19***	***6***	***Edge Start***		***0.11***

Material Thickness	Gas Pressure (Air)	Arc Voltage	Torch Working Height	Travel Speed	Initial Piercing Height	Pierce Delay	Kerf Width @ Rec. Speed
(mm)	Bar (torch lead length)	Volts	(mm)	(mm/min)	(mm)	(sec)	(mm)
1	5.9 (7.6m) 6.2 (15.2m)	115	4.8	7540	4.8	0	2.1
2		120	4.8	7015	4.0	0.10	1.9
3		118	4.8	4570	4.8	0.10	0.1
4		120	4.8	3650	4.8	0.20	1.9
5		121	4.8	2465	4.8	0.20	2.1
6		122	4.8	2145	4.8	0.30	2.0
8		123	4.8	1635	4.8	0.40	2.2
10		125	4.8	1180	4.8	0.60	2.4
12		**130**	**4.8**	**795**	**4.8**	**0.75**	**2.4**
15		***134***	***4.8***	***530***	***Edge Start***		***2.4***
20		***138***	***4.8***	***325***	***Edge Start***		***2.2***
25		***149***	***4.8***	***165***	***Edge Start***		***2.7***

Stainless Steel – 60A

Deflector	Standard Shield Cup Maximum Life Shield Cup	Tip	Starter Cartridge	Electrode
9-8243	9-8237	9-8210	9-8213	9-8232

Material Thickness			Gas Pressure (Air)	Arc Voltage	Torch Working Height	Travel Speed	Initial Piercing Height	Pierce Delay	Kerf Width @ Rec. Speed
(GA)	(in)	inch	PSI (torch lead length)	Volts	(in)	(ipm)	(in)	(sec)	(in)
16		0.063	85 (25') 90 (50')	119	0.19	350	0.20	0.00	0.05
14		0.078		116	0.19	300	0.20	0.10	0.07
11		0.125		123	0.19	150	0.20	0.10	0.07
10		0.141		118	0.19	125	0.20	0.10	0.08
	3/16	0.188		122	0.19	90	0.20	0.20	0.08
	1/4	0.250		123	0.19	65	0.20	0.30	0.09
	3/8	0.375		130	0.19	30	0.20	0.50	0.09
	1/2	**0.500**		**132**	**0.19**	**21**	**0.20**	**0.90**	**0.08**
	5/8	***0.625***		***132***	***0.19***	***14***	***Edge Start***		***0.11***
	3/4	***0.750***		***135***	***0.19***	***10***	***Edge Start***		***0.10***

Material Thickness	Gas Pressure (Air)	Arc Voltage	Torch Working Height	Travel Speed	Initial Piercing Height	Pierce Delay	Kerf Width @ Rec. Speed
(mm)	Bar (torch lead length)	Volts	(mm)	(mm/min)	(mm)	(sec)	(mm)
1	5.9 (7.6m) 6.2 (15.2m)	124	4.8	10890	5.1	0.00	0.8
2		116	4.8	7560	5.1	0.10	1.7
3		122	4.8	4365	5.1	0.10	1.7
4		119	4.8	2865	5.1	0.20	2.1
5		122	4.8	2195	5.1	0.20	2.1
6		123	4.8	1790	5.1	0.30	2.2
8		127	4.8	1190	5.1	0.40	2.2
10		130	4.8	725	5.1	0.50	2.2
12		**132**	**4.8**	**580**	**5.1**	**0.90**	**2.1**
15		***132***	***4.8***	***405***	***Edge Start***		***2.6***
20		***136***	***4.8***	***230***	***Edge Start***		***2.5***

Aluminum – 60A

Deflector		Standard Shield Cup Maximum Life Shield Cup		Tip	Starter Cartridge		Electrode	
9-8243		9-8237		9-8210	9-8213		9-8232	
Material Thickness			Gas Pressure (Air)	Arc Voltage	Torch Working Height	Travel Speed	Initial Piercing Height	Pierce Delay	Kerf Width @ Rec. Speed
(GA)	(in)	inch	PSI (torch lead length)	Volts	(in)	(ipm)	(in)	(sec)	(in)
16		0.064	85 (25') 90 (50')	123	0.25	440	0.25	0.00	0.08
14		0.079		126	0.25	300	0.25	0.10	0.09
11		0.120		128	0.25	250	0.25	0.10	0.09
	3/16	0.188		132	0.25	170	0.25	0.20	0.09
	1/4	0.250		132	0.25	85	0.25	0.30	0.09
	3/8	0.375		141	0.25	45	0.25	0.50	0.10
	1/2	**0.500**		**148**	**0.25**	**30**	**0.25**	**0.80**	**0.09**
	5/8	***0.625***		***145***	***0.19***	***18***	***Edge Start***		***0.08***
	3/4	***0.750***		***147***	***0.19***	***12***	***Edge Start***		***0.10***

Material Thickness	Gas Pressure (Air)	Arc Voltage	Torch Working Height	Travel Speed	Initial Piercing Height	Pierce Delay	Kerf Width @ Rec. Speed
(mm)	Bar (torch lead length)	Volts	(mm)	(mm/min)	(mm)	(sec)	(mm)
1	5.9 (7.6m) 6.2 (15.2m)	118	6.4	17010	6.4	0.00	1.8
2		126	6.4	7680	6.4	0.10	2.3
3		128	6.4	6410	6.4	0.10	2.3
4		130	6.4	5230	6.4	0.20	2.3
5		132	6.4	4010	6.4	0.20	2.4
6		132	6.4	2640	6.4	0.30	2.4
8		137	6.4	1630	6.4	0.40	2.4
10		142	6.4	1085	6.4	0.60	2.4
12		**146**	**6.4**	**845**	**6.4**	**0.70**	**2.3**
15		***146***	***4.8***	***540***	***Edge Start***		***2.1***
20		***148***	***4.8***	***260***	***Edge Start***		***2.5***

Mild Steel – 40A

Deflector		Standard Shield Cup Maximum Life Shield Cup		Tip	Starter Cartridge		Electrode	
9-8243		9-8237		9-8208	9-8213		9-8232	
Material Thickness			Gas Pressure (Air)	Arc Voltage	Torch Working Height	Travel Speed	Initial Piercing Height	Pierce Delay	Kerf Width @ Rec. Speed
(GA)	(in)	inch	PSI (torch lead length)	Volts	(in)	(ipm)	(in)	(sec)	(in)
20		0.036	70 (25') 75 (50')	101	0.14	160	0.18	0.0	0.05
16		0.060		103	0.14	140	0.18	0.0	0.05
14		0.075		105	0.14	120	0.18	0.1	0.06
12		0.105		108	0.14	80	0.18	0.2	0.06
10		0.135		110	0.14	60	0.18	0.3	0.06
	3/16	0.188		111	0.14	55	0.18	0.4	0.06
	1/4	0.250		117	0.14	40	0.18	0.5	0.07
	3/8	0.375		119	0.14	25	0.18	1.2	0.07
	1/2	**0.500**		**120**	**0.14**	**15**	**0.2**	**2.0**	**0.07**

Material Thickness	Gas Pressure (Air)	Arc Voltage	Torch Working Height	Travel Speed	Initial Piercing Height	Pierce Delay	Kerf Width @ Rec. Speed
(mm)	Bar (torch lead length)	Volts	(mm)	(mm/min)	(mm)	(sec)	(mm)
1	4.8 (7.6m) 5.2 (15.2m)	101	3.6	3990	4.6	0.0	1.1
2		105	3.6	2920	4.6	0.1	1.4
3		109	3.6	1810	4.6	0.3	1.5
4		110	3.6	1470	4.6	0.3	1.6
5		112	3.6	1345	4.6	0.4	1.6
6		116	3.6	1100	4.6	0.5	1.7
8		118	3.6	815	4.6	1.0	1.7
10		119	3.6	595	4.6	1.5	1.8
12		**120**	**3.6**	**435**	**5.1**	**2.0**	**1.8**

Stainless Steel – 40A

Deflector		Standard Shield Cup Maximum Life Shield Cup		Tip	Starter Cartridge		Electrode	
9-8243		9-8237		9-8208	9-8213		9-8232	
Material Thickness			Gas Pressure (Air)	Arc Voltage	Torch Working Height	Travel Speed	Initial Piercing Height	Pierce Delay	Kerf Width @ Rec. Speed
(GA)	(in)	inch	PSI (torch lead length)	Volts	(in)	(ipm)	(in)	(sec)	(in)
18		0.050	75 (25') 80 (50')	110	0.19	60	0.20	0.00	0.07
16		0.063		100	0.19	50	0.20	0.00	0.07
14		0.078		105	0.19	45	0.20	0.10	0.07
12		0.109		110	0.19	40	0.20	0.20	0.07
10		0.141		108	0.19	35	0.20	0.30	0.07
	3/16	0.188		110	0.19	30	0.20	0.40	0.07
	1/4	0.250		120	0.19	18	0.20	0.50	0.08
	3/8	**0.375**		**126**	**0.19**	**10**	**0.20**	**2.00**	**0.08**
	1/2	***0.500***		***118***	***0.19***	***8***	***Edge start***		***0.09***

Material Thickness	Gas Pressure (Air)	Arc Voltage	Torch Working Height	Travel Speed	Initial Piercing Height	Pierce Delay	Kerf Width @ Rec. Speed
(mm)	Bar (torch lead length)	Volts	(mm)	(mm/min)	(mm)	(sec)	(mm)
1	5.2 (7.6) 5.5 (15.2)	112	4.8	1670	4.8	0.0	1.7
2		105	4.8	1140	5.1	0.1	1.8
3		109	4.8	980	5.1	0.2	1.8
4		109	4.8	845	5.1	0.3	1.8
5		111	4.8	715	5.1	0.4	1.8
6		118	4.8	525	5.1	0.5	2.0
8		123	4.8	350	5.1	1.5	2.0
10		**125**	**4.8**	**245**	**5.1**	**2.0**	**2.0**
12		***120***	***4.8***	***215***	***Edge Start***		***2.2***

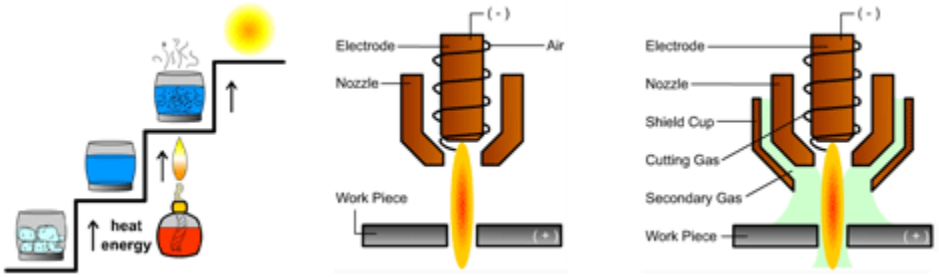
Aluminum – 40A

Deflector	Standard Shield Cup Maximum Life Shield Cup		Tip	Starter Cartridge		Electrode	
9-8243	9-8237		9-8208	9-8213		9-8232	
Material Thickness		Gas Pressure (Air)	Arc Voltage	Torch Working Height	Travel Speed	Initial Piercing Height	Pierce Delay	Kerf Width @ Rec. Speed
(GA)	(in) inch	PSI (torch lead length)	Volts	(in)	(ipm)	(in)	(sec)	(in)
20	0.040	70 (25') 75 (50')	95	0.16	300	0.16	0.0	0.06
16	0.063		97	0.16	170	0.16	0.0	0.06
12	0.097		113	0.16	100	0.16	0.2	0.07
11	0.125		115	0.16	90	0.18	0.3	0.07
9	0.160		113	0.18	85	0.18	0.4	0.07
3/16	0.188		116	0.18	75	0.18	0.5	0.07
1/4	**0.250**		**128**	**0.18**	**30**	**0.18**	**1.0**	**0.08**
3/8	***0.375***		***150***	***0.18***	***10***	***Edge Start***		***0.09***

Material Thickness	Gas Pressure (Air)	Arc Voltage	Torch Working Height	Travel Speed	Initial Piercing Height	Pierce Delay	Kerf Width @ Rec. Speed
(mm)	Bar (torch lead length)	Volts	(mm)	(mm/min)	(mm)	(sec)	(mm)
1.0	4.8 (7.6m) 5.2 (15.2m)	95	4.1	7620	4.1	0.0	1.5
2.0		104	4.1	3500	4.1	0.2	1.6
3.0		115	4.1	2350	4.6	0.3	1.7
4.0		113	4.6	2170	4.6	0.4	1.7
5.0		118	4.6	1740	4.6	0.5	1.8
6.0		**125**	**4.6**	**1015**	**4.6**	**0.8**	**1.9**
8.0		***139***	***4.6***	***500***	***Edge Start***		***2.0***
10.0		***153***	***4.6***	***180***	***Edge Start***		***2.2***

Plasma Education

What is Plasma?



What is Plasma? The Fourth State of Matter

One common description of plasma is to describe it as the fourth state of matter. We normally think of the three states of matter as solid, liquid and gas. For a common element, water, these three states are ice, water and steam. The difference between these states relates to their energy levels. When we add energy in the form of heat to ice, the ice melts and forms water. When we add more energy, the water vaporizes into hydrogen and oxygen, in the form of steam. By adding more energy to steam these gases become ionized. This ionization process causes the gas to become electrically conductive. This electrically conductive, ionized gas is called plasma.

How Plasma Cuts Through Metal

The plasma cutting process, as used in the cutting of electrically conductive metals, utilizes this electrically conductive gas to transfer energy from an electrical power source through a plasma cutting torch to the material being cut.

The basic plasma arc cutting system consists of a power supply, an arc starting circuit and a torch. These system components provide the electrical energy, ionization capability and process control that is necessary to produce high quality, highly productive cuts on a variety of different materials.

The power supply is a constant current DC power source. The open circuit voltage is typically in the range of 240 to 400 VDC. The output current (amperage) of the power supply determines the speed and cut thickness capability of the system. The main function of the power supply is to provide the correct energy to maintain the plasma arc after ionization.

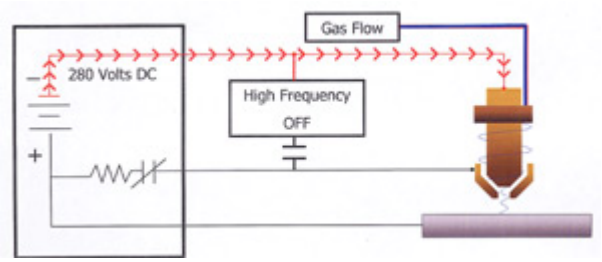
The arc starting circuit is a high frequency generator circuit that produces an AC voltage of 5,000 to 10,000 volts at approximately 2 megahertz. This voltage is used to create a high intensity arc inside the torch to ionize the gas, thereby producing the plasma.

The Torch serves as the holder for the consumable nozzle and electrode, and provides cooling (either gas or water) to these parts. The nozzle and electrode constrict and maintain the plasma jet.

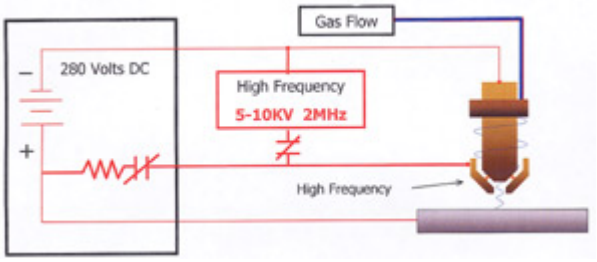
Sequence of Operating a Plasma Cutter

The power source and arc starter circuit are connected to the torch via interconnecting leads and cables. These leads and cables supply the proper gas flow, electrical current flow and high frequency to the torch to start and maintain the process.

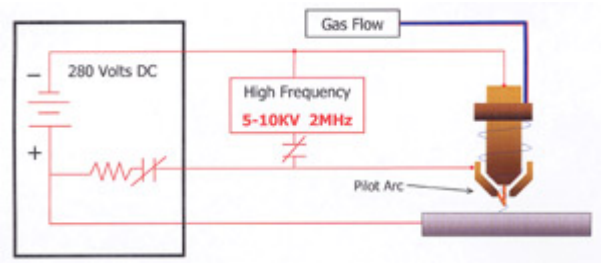
1. A start input signal is sent to the power supply. This simultaneously activates the open circuit voltage and the gas flow to the torch (see Figure 2). Open circuit voltage can be measured from the electrode (-) to the nozzle (+). Notice that the nozzle is connected to positive in the power supply through a resistor and a relay (pilot arc relay), while the metal to be cut (work piece) is connected directly to positive. Gas flows through the nozzle and exits out the orifice. There is no arc at this time as there is no current path for the DC voltage.



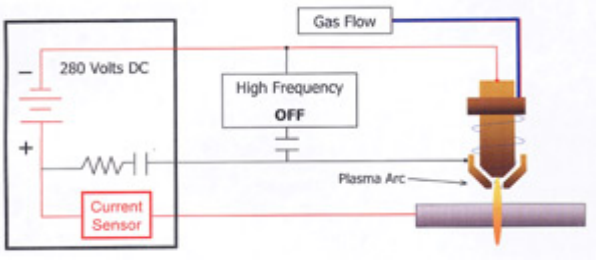
2. After the gas flow stabilizes, the high frequency circuit is activated. The high frequency breaks down between the electrode and nozzle inside the torch in such a way that the gas must pass through this arc before exiting the nozzle. Energy transferred from the high frequency arc to the gas causes the gas to become ionized, therefore electrically conductive. This electrically conductive gas creates a current path between the electrode and the nozzle, and a resulting plasma arc is formed. The flow of the gas forces this arc through the nozzle orifice, creating a pilot arc.



3. Assuming that the nozzle is within close proximity to the work piece, the pilot arc will attach to the work piece, as the current path to positive (at the power supply) is not restricted by a resistance as the positive nozzle connection is. Current flow to the work piece is sensed electronically at the power supply. As this current flow is sensed, the high frequency is disabled and the pilot arc relay is opened. Gas ionization is maintained with energy from the main DC arc.



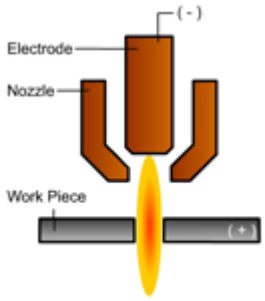
4. The temperature of the plasma arc melts the metal, pierces through the work piece and the high velocity gas flow removes the molten material from the bottom of the cut kerf. At this time, torch motion is initiated and the cutting process begins.



Variations of the Plasma Cutting Process

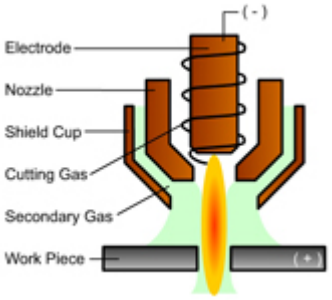
Conventional Plasma Cutting

This process generally uses a single gas (usually air or nitrogen) that both cools and produces the plasma. Most of these systems are rated at under 100 Amps, for cutting materials under 5/8" thick. Primarily used in hand held applications.



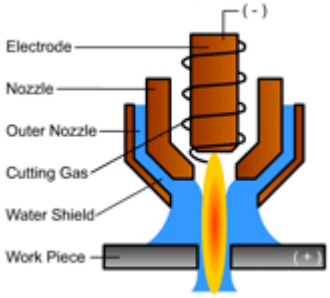
Dual Gas Plasma Cutting

This process utilizes two gases; one for the plasma and one as a shield gas. The shield gas is used to shield the cut area from atmosphere, producing a cleaner cut edge. This is probably the most popular variation, as many different gas combinations can be used to produce the best possible cut quality on a given material.



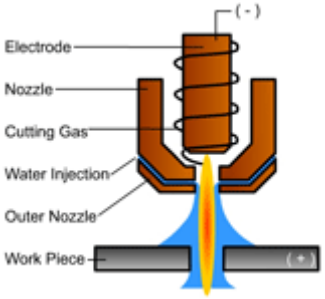
Water Shield Plasma Cutting

This is a variation of the dual gas process where water is substituted for the shield gas. It produces improved nozzle and work piece cooling along with better cut quality on stainless steel. This process is for mechanized applications only.



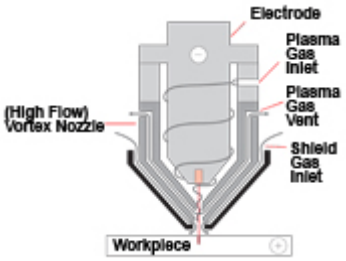
Water Injection Plasma Cutting

This process uses a single gas for plasma and utilizes water either radially or swirl injected directly into the arc to greatly improve arc constriction, therefore arc density and temperatures increase. This process is used from 260 to 750 amps for high quality cutting of many materials and thicknesses. This process is for mechanized applications only.



Precision Plasma Cutting

This process produces superior cut quality on thinner materials, (less than 1/2") at slower speeds. This improved quality is a result of using the latest technology to super constrict the arc, dramatically increasing energy density. The slower speeds are required to allow the motion device to contour more accurately. This process is for mechanized applications only.



Glossary

The following words are most commonly used in reference to the plasma system and associated activities.

Axis - A direction in a coordinate system. Plasma units have 3 axes: X, Y, and Z.

Axis Motor - A motor that causes motion in a particular axis.

Bad Slag - The molten metal that quickly cools and requires a grinder for removal.

Bar Code Scanner - A device that allows operators to retrieve information encoded in a bar code label so that specific notes and directions are kept in line with the correct job file.

Bearing Car - The bearing on which an axis moves along a rail, also known as a bearing truck. There are two bearing cars for each rail.

Bearing Rail - The rail on which the bearing cars ride. There are 2 rails for each axis.

Bevel - The angularity between the material surface and the cut edge.

Bite Size - The depth of each pass, used in multipass.

Climb Cut - A direction the plasma unit moves along a cut to produce a climbing motion. For a closed contour, the climb cut is clockwise on the outside of the cut and counter-clockwise on the inside of the cut.

Consumables - The components that are used up in the cutting process.

Conventional Cut - The opposite cut of a climb cut, or closed counter-clockwise on the outside of the cut and clockwise on the inside of the cut.

Cross-over Cable - The type of Ethernet connection that is directly connected to the computer

Cut Height - The Cut Height function is used to indicate the distance the cutting tip is above the surface of the material on a cutting move.

Cut Speed - A Hot Key function that sets the speed of the cut.

Dross - A byproduct of plasma caused by heating a material to its melting point and blowing that material away; also referred to as slag.

Dry Run - A controller function that will execute a file with no Z-axis movement. Dry Run is used to show the operator where the tool will go during the cutting sequence.

Emergency Stop - The red mushroom button located on the screen, as well as on the side of the plasma unit, used to remove power from the machine excluding the controller board and limit switches.

External Halt - The keypad display that appears when power is applied to the system with the Emergency Stop button pushed in on the keypad pendant.

Feedrate Override - A Hot Key used to adjust the cutting feedrate of the system while a file is being executed.

Fiducial - A reference mark, or dot, used in MultiVision that allows the CNC machine to recognize the orientation of the material and adjust the cut file accordingly.

Firmware - The operating system of the controller that should only be loaded when instructed. Firmware contains all of the low-level commands and is the first level of controller software.

Flash RAM File - A file containing all of the machine parameters of a particular plasma unit. Settings such as table size and resolution are located in the Flash RAM File, which is the third level of controller software.

Gantry - The mechanical part of the plasma unit, also known as the bridge, which moves the head assembly from the front to the rear of the table.

G Code - The machine code language used by the controller to execute motion commands.

Gearbox- The drive system on Pro series that uses planetary gear reduction to produce rotation of the pinion.

Good Slag - The slag which falls away easily and requires little effort to remove.

Hard Home Position - The home position determined by the location of the targets and limit switches, typically at the front right side of the table.

Head - A reference to the particular cutting tool (i.e. Spindle, Plasma torch, Laser, or Oxyacetylene torch).

Head Mode - A designation for multiple head machines, either All or Auto.

Heat Affection - The heat treatment of the edge that is caused by the intense heat created by plasma.

Height Offset - An externally selected deviation either above or below the set point.

Hot Keys - The one-touch keys on the keypad that perform controller functions.

HPGL - The machine code language that the system executes as a file.

Init File - The second level controller software that contains high level commands.

Kerf - The width of the cut.

Keypad - The part of the pendant with the grid of Hot Keys.

Lift Height - The Z-axis distance between the bottom of the plasma unit and the material. The Lift Height is also the location of the head assembly during a slew move.

Light Curtain - A boundary around the machine created by parallel, infrared light beams that stops the cutting sequence once an object or person crosses the beams.

Machine Parameters Menu - A tool of the Productivity Software Suite that allows the flash RAM file to be modified.

Menu System - The commands that are not assigned to Hot Keys.

Node - A computer or device that is connected to a Class C or Private network, which is common in most businesses.

Operator Station - The stand-alone board separate from the machine and keypad that allows the operator to turn on auxiliary systems or access dual systems if applicable.

Park - The function used in all 3 axes to place the head assembly at the farthest point away from the material for loading and unloading.

Patch Cable - The type of Ethernet connection that is connected to the computer through a networking component such as a hub, switch, or router.

Pause - The yellow button on the keypad that puts the controller into Pause mode where action is momentarily stopped and can be restarted at the keypad.

Pendant - The control module consisting of the keypad and mechanical inputs.

Plasma - The fourth state of matter, or superheated ionized gas used to cut ferrous materials.

Programmable Soft Home - The 9 possible home positions that the operator can store to be recalled at a later time.

Proximity Restart - The controller function that allows the operator to restart a file along any cut move after an interruption such as power outage or tool breakage.

Rack and Pinion - A system of transferring movement from the rotation of the motors to the linear movement of the system by way of gears.

Self-Test - A controller function that allows the system to test itself. The self-test is accessed from the menu system.

Serial Cable - The RS232 cable used to transfer data from the host PC to the controller.

Servo Drive - The Servo amplifier used to move the servo motors.

Servo Motor - The axis motor on a servo system.

Side Cover - The covers on each end of the gantry protecting the X-axis motor and limit switches.

Slag - A byproduct of plasma caused by heating a material to its melting point and blowing the material away; also referred to as dross.

Slew - A non-cutting movement of the system above the material at maximum speed.

Soft Home Position - Any set home position used as the origin for executing programs.

Stepper Drive - An amplifier that controls the action of the stepper motors.

Stepper Motor - An axis motor that uses stepper technology.

Surface - The topside of the material used as the Z-axis reference point.

Swirl - The motion of the gases in plasma units necessary to constrict the arc.

Tool Offset - The distance between the center of the plasma unit and the cutting edge. The Tool Offset is also the distance between the desired geometry and the center of the tool path, usually the radius of the plasma unit.

Tool Path - The path that the center of the plasma unit takes during a cut.

Transmission - The drive system on SF series using a 4:1 belt drive pulley system to produce rotation of the pinion.

µCito - The native language of the controller (pronounced micro-see-tow).

Vector - A line segment showing a particular direction or path.

X-axis - The axis that refers to the length of the table, front to back.

X Motor Plate - The plate attached to the side of the gantry in which the transmission or gearbox assemblies are bolted.

Y-axis - The axis that refers to the width of the table, left to right.

Y Carriage Plate - The vertical plate behind the Z-axis carriage plate where Z-axis bearing rails are mounted.

Y Motor Plate - The horizontal plate attached to the Y-carriage plate where the Y-axis transmission or gearbox assemblies are bolted.

Z-axis - The axis that refers to the accessible range of the area above the table.

Z Carriage Plate - The vertical plate on the vertical moving part of the carriage assembly where the cutting tool plate is mounted.

Z Motor Plate - The horizontal plate on top of the Y-carriage plate where the Z-axis motor is mounted.

Z Speed - The vertical speed of the head assembly.

Troubleshooting & Error Codes

If an error code is displayed on the computer or on the plasma power supply, please do the following:

- Please read the error code in Job Console and/or on the plasma power supply
    - For error codes in Job Console, please refer to this user manual
    - For error codes on the plasma power supply, please refer to the user manual for your plasma unit
- Follow the instructions for the error code displayed in Job Console or for the error code on the plasma power supply
- Inspect and verify the following:
    - Cut procedures
    - Consumable stack
    - Air pressure
    - Drawing (if you are cutting a .dxf file created from another source)
    - Cleanliness of the material being cut
- Please try and solve the problem yourself initially. Understanding how to solve these issues will you give you a greater understanding of your machine, and its capabilities.
- Write down the steps you have taken to try and resolve the issue
    - Make sure to write these steps down in the same sequence that you applied them, and please be very detailed

- If you are unable to remove an error code, do the following:
    - Turn off the controller and let the drives disengage
    - Turn the controller back on

- If the problem continues:
    - Turn off the computer, controller, and plasma power supply
    - Turn the computer, controller, and plasma power supply back on
    - Open Connection Manager and establish a connection by opening Motion Mechanic
    - Type f6 for <, type in cold, and then press enter to reboot the software

- If you have cancel a cut before its completion in order to clear an error:
    - Hit  to cancel the cut
    - Clear the error code by following the steps covered in the previous sections
    - In Job Console, move the crosshairs to the restart position
        - Zoom in to see the contour better
    - Ensure the crosshairs are at the position where you had previously stopped your cut

    - Click Execution on the menu bar at the top of the page, and select Execute from Current Position 
    - Click Play 

- If you are still running into problems, please contact a representative from EZ Cut CNC. Please make sure to have your notes on hand to expedite the process.
    - Kevin Saffa – kevin@ezcutcnc.com, (314) 303-2038
    - Steve Dinsmore – steve@ezcutcnc.com, (810) 941-7790
    - Jim Delaney – jim@ezcutcnc.com, (314) 614-7567

Error Codes

Error Code	Cause	Solution
Check E-Stop!	The Emergency Stop button is pushed in.	Pull out the Emergency Stop button and reset Machine Home.
Find Limits Failed!	The controller cannot enable motion, and the motion buffer is not defined.	Make sure the Emergency Stop is **not** active.
Machine Not Homed!	The operator has not found Machine Home. The machine loses its Home position upon first boot, after an Emergency Stop, or after a system interruption.	Press  , then press 
Out of Bounds	The operator selected a location that is beyond the X, Y, or Z boundaries.	Correct the location coordinates in the system.
System Interrupt: XA Home	The proximity switch for the Xa-axis has prematurely been tripped. Something is obstructing the sensor, the sensor is not getting any power, or there is too much space between the proximity switch and the sensor.	Make sure the Xa proximity switch is receiving power, and is completely unobstructed. Check wiring leading to proximity switch. There should be a credit card's width (0.03 inches) of space between the proximity switch and the sensor.
System Interrupt: XB Home	The proximity switch for the Xb-axis has prematurely been tripped. Something is obstructing the sensor, the sensor is not getting any power, or there is too much space between the proximity switch and the sensor.	Make sure the Xb proximity switch is receiving power, and is completely unobstructed. Check wiring leading to proximity switch. There should be a

		credit card's width (0.03 inches) of space between the proximity switch and the sensor.
System Interrupt: Y Home	The proximity switch for the Y-axis has prematurely been tripped. Something is obstructing the sensor, the sensor is not getting any power, or there is too much space between the proximity switch and the sensor.	Make sure the Y proximity switch is receiving power, and is completely unobstructed. Check wiring leading to proximity switch. There should be a credit card's width (0.03 inches) of space between the proximity switch and the sensor.
System Interrupt: Z Home	The proximity switch for the Z-axis has prematurely been tripped. Something is obstructing the sensor, the sensor is not getting any power, or there is too much space between the proximity switch and the sensor.	Make sure the Z proximity switch is receiving power, and is completely unobstructed. Check wiring leading to proximity switch. There should be a credit card's width (0.03 inches) of space between the proximity switch and the sensor.
Waiting on Arc…Enter to re-try or CANCEL to Abort	Something is causing the arc to not work.	Ensure your PSI is adequate. Clean/Change out consumables. Ensure arc is not running off the plate.

Thickness Not Found	Material file is corrupt.	Delete corrupt file and create a new one.
Surf Override Sensor Pause Press CANCEL to Abort	Dirty consumables.	Clean/Change out dirty consumables.
Surface Block	Positive tip on the plasma torch, reference is ground during motion; surface proximity switch is engaged; consumables are coming into contact with the material or torch ran into metal while the arc is on.	Cancel cut, remove & clean consumables. Check procedures and remove Lead Outs if material is less than or equal to ½" thick.
Ohmic Sensor not Released	There is debris in the consumables of the plasma torch; the Ohmic clip is not making contact with the torch shield	Clean consumables; ensure that Ohmic clip is wired properly and making contact with the torch shield.

Fume Extraction

A Fume Extraction system is recommended for all plasma systems so as to properly handle the fumes and particulates that result from cutting any material. EZ Cut systems can be purchased with or without a fume extraction system and are compatible for use with other manufacturers' fume extraction systems. The plasma system can be purchased independently of the fume extraction system, though the frequency of maintenance is similar for both machines and should be followed to extend the life of both the plasma system and fume extraction system.

The type of material being cut by the plasma system determines the type of fume extraction system most appropriate for the plasma system. All operators should **consult local authorities** prior to installing any fume extraction system as different materials will produce specific fumes and particulates that would be better handled by certain types of fume extraction systems. Operators may refer to any EZ Cut Technician for recommendations on a Fume Extraction system for their plasma system.

The fume extraction system must be turned on and off independently of the plasma system and no adjustments need to be made to the system once it is on. Operators should refer to the OSHA guidelines for their state in regards to the proper setup of the fume extraction system, recognizing that OSHA can order an investigation if they learn of any disregard for those guidelines.

The Fume Extraction system includes a ribbed hose for connection, and operators are encouraged to purchase a hard plumbing hose to extend the efficiency of the fume extraction system. All connectors can be purchased at a regular hardware store, and operators should refer to the user manual provided with the fume extraction system for the proper dimensions of those connecting hoses.